AN INVESTIGATION OF LOCKHEED'S SOLVENCY BY USE OF FINANCIAL RATIOS

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THESIS

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by

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An Investigation of Lockheed's Solvency by Use of Financial Ratios

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I. INTRODUCTION

Lockheed Aircraft Corporation claimed to be facing bankruptcy in 1971 because it was running out of cash. [Ref. 1] This situation, coupled with the actual bankruptcy of Rolls-Royce Ltd., caused the British government and Lockheed to petition the United States Government for an emergency loan guarantee of $250 million.

The guarantee was approved in the form of a bill called the Emergency Loan Guarantee Act by the Senate on a slim 49-48 vote. The closeness of the vote hints at the controversy that preceeded the final decision. Many senators felt that Lockheed had no grounds for requesting this assistance and felt that the company would receive financial help from its banks with or without a guarantee. Others felt that the natural processes of competition were at work and the government had no right in manipulating the economy. [Ref. 2]

The majority, however, felt that the company was in real danger of going bankrupt and needed Federal financial assistance in order to survive. Lockheed's position as a major defense contractor and also the request of the British government were important factors to be considered.

Whether Lockheed would have failed if the Senate had rejected the loan will never really be known. However, several previous empirical studies have produced some important theories on the predictability of financial failure. It is the intent of this thesis to use these former studies as a base and attempt to determine whether Lockheed was on the path to bankruptcy in the year 1971. Also

included will be an similar analysis for the years 1971-1972, since Lockheed again claimed to face cash problems when financially troubled Eastern Air Lines asked for a stretched-out delivery schedule of its ordered L-1011s. [Ref. 3]

Those previous works that play an important part in this thesis are two studies by William Beaver in 1966 and 1968 and a study by Paul Dascher in 1970. Several important observations were gleaned from these three studies that, their authors claimed, were highly predictive of failure. Two of these observations were the following:

1. Non-liquid asset ratios predict failure better than liquid asset ratios.

2. Failed firms' ratios tend to deteriorate markedly from those of non-failed firms as failure approaches.

These symptoms seemed to fit very well the situation of Lockheed Aircraft Corporation in the 1966-1970 time-period. Many of Lockheed's ratios were quite different than those of the rest of the industry--especially the non-liquid asset ratios. These differences seemed to become more pronounced as 1971 approached. Lockheed's average ranking by ratios in the industry declined markedly over the period of this study. It was these main points that led to the conclusion that Lockheed was headed for failure.

The ratios for 1971 and 1972 show also that Lockheed is below the industry average. However, these ratios, while low, are not as bad as they were in 1970. Several of the ratios are in a downward trend. Nevertheless, while the ratios reflect a dependence on inventory realization, they still have not degenerated in 1972 to the point where subsequent bankruptcy is evident.

II. HISTORY OF LOCKHEED

Lockheed Aircraft Corporation was incorporated on June 21, 1932. It succeeded the Lockheed Aircraft Company (incorporated in 1926 in Delaware), which was to become the heavier-than-air division of the Detroit Aircraft Corporation. The latter company went bankrupt but Lockheed lived on. The newly incorporated firm's first successful plane was the Model 10 "Electra." More than 150 of these were sold to domestic and foreign airlines before the start of the Second World War.

The success of the Electra-10 didn't end there, however, as modifications thereto produced the Model 12 and Model 14. One hundred and fourteen units of the "12" were sold. The Model 14 "Sky Zephyr" was converted to a bomber, and the British initially bought 200 of these in 1937. The performance of the plane, which became known as the B-14 "Hudson," was praised highly by the British; and they subsequently bought over 1,000 of them before the war's end.

Lockheed also introduced the Model 18 "Lodestar" and was working on the 4-engine "Constellation" in the late thirties, but, as the war approached, the company's efforts shifted from civilian aviation to military needs. During the war the company produced 10 per cent of the total American output of war planes, some 15,000 units. These included the P-38 "Lightning," the "Hudson," the B-17 "Flying Fortress," the "Harpoon," and the "Ventura PV."

A. WAR'S END TO THE SIXTIES

With the war winding down, Lockheed turned its attention back to the commercial market and pushed development of a 100-seat passenger plane it had designed initially for Pan-Am in 1940. This previous work gave Lockheed an advantage over competition, and the corporation aggressively marketed the new "Constellation." (Orville Wright piloted the plane in a demonstration flight.) [Ref. 4] The "Connie" became one of the most familiar commercial aircraft ever produced.

The advent of the 'cold war' refocused attention on military aircraft production, and Lockheed quickly established itself as a leader in that field with the P-80 "Shooting Star," the first operational jet fighter. The P-80 (later the name was changed to the F-80) was modified to become the T-33 "T-Bird," and this plane was in turn modified to become the F-94 "Starfire." All three were highly regarded by the military and over 7,000 of these planes were sold - 800 F-80's, 6,000 T-33's, and 600 F-94's. Another successful post-war plane was the P2V "Neptune," used primarily by the Navy for ASW work. Other profitable ventures in the fifties were the C-130 "Hercules" and the F-104 "Star-Fighter." Both were extremely successful and, although introduced in the early fifties, both are still operational in 1974.

Contrasting with these notable successed, however, were several failures. The list includes the "Constitution," the "Saturn," the "Little Dipper," the "Big Dipper," and the "Jetstar." As the decade came to a close, the successes of the company pushed Lockheed toward a position of being heavily dependent on the military.

The "Constellation" was its only highly successful civilian venture and, even at that, many were sold to the military.

With this in mind the company attempted to enter the commercial market (it's first love) [Ref. 5, p. 45] with the Electra, a new passenger plane with the same name as its 1930s' predecessor. It was a turbo-prop introduced late in the 1950s', just when Lockheed's competitors were about to deliver the first jet airliners. The Boeing 707 and the Douglas DC8 swept the Electra and Lockheed from the commercial airliner market. [Ref. 6, p. 4] In addition, two well publicized crashes of the Electra sapped its potential even further. The Electra experience made the company even more military-dependent than before.

As Lockheed grew during the fifties, it diversified into other areas. It set up the Lockheed Missile Systems Division in 1953. It purchased Puget Sound Bridge and Dry Dock Company in 1959 and entered the shipbuilding, ship repair and general construction business.

B. THE SIXTIES

The early years of the decade of the 1960s' were a time of cold war, response to the Sputnik and increased defense spendings. The United States was becoming more involved in the Viet Nam War. Lockheed, being highly military-oriented, was in an excellent position to take advantage of the path the United States was to follow.

Lockheed was prime contractor for the Polaris missile program and its follow-on, the Poseidon. Through modification, the commercially disastrous Electra turned into a military profit maker. It

became known as the P-3 "Orion" and took over the role of the P-2V as an ASW patrol plane. The company won contracts for building destroyer escorts and amphibious assault transports for the Navy. Also, Lockheed was to build the C5A for the Air Force, the Cheyenne Helicopter for the Army and the SRAM rocket motor for Boeing Aircraft Corp. These contracts helped Lockheed become the largest Defense contractor in the years 1962-1966. (It was #2 in 1961 and 1968 and #3 in 1967.) Lockheed's good fortune was reflected in its stock price and its ability to place debentures. [Ref. 7]

However, Lockheed did find itself excessively dependent on military contracts (90% of its sales during the 1960s' were to DOD). Hence, on May 2, 1967 it disclosed plans that it was exploring three new commercial ventures. This occured after losing to Boeing in the bidding for the SST contract. The three programs were a large frame subsonic passenger jet, a commercial air cargo plane and a rigid rotor commercial helicopter. [Ref. 8] Later that year, the decision to produce a large passenger jet plane was made and the L-1011 "Tristar" was born.

1. A Crisis Begins

Troubles were beginning to mount in the late sixties when problems with several defense contracts became apparent. Costs were running higher than contracts allowed, and Congressional criticism of excess defense spending was becoming fashionable.

Four of Lockheed's programs came under sharp scrutiny. These were the C5A, the Cheyenne Helicopter, the SRAM motor and several Navy shipbuilding contracts. The first three of these programs were under "total package" procurement contracts covering both

design and production. Secretary of Defense Robert MacNamara had introduced this contracting concept earlier in the decade. Prior to the total package concept, DOD would contract for the design phase of a system and the production phase separately. This usually led to the winner of the design phase ultimately winning the production phase, and the total package contract was instituted to overcome a resultant problem. It was charged that contractors bid exceedingly low on the design phase in the knowledge that they could cover their losses on the production phase.

While the total package idea was well meant, Melvin Laird, Secretary of Defense in the late sixties, rejected it as unworkable. Contractors said that ultimate costs were impossible to estimate. Although complex clauses in this type of contract were supposed to protect both buyer and seller as program changes were made, they more often led to sharp disagreements. Lockheed claimed that the total package system had proved virtually unworkable and that existing contracts should be revised. [Ref. 9] The company also admitted being overly optimistic in its bidding, however. [Ref. 10]

When Lockheed didn't get what it considered fair payments, it took its case to the Armed Services Board of Contract Appeals. However, a decision here would take years and, in the meantime, the company had to live under the contracts it originally signed. Lockheed's on-going programs, meanwhile, were causing a tremendous cash drain. The crisis came to a boil on March 6, 1970, when Lockheed threatened to stop work on the four programs if it didn't receive iterim financing. [Ref. 9] DOD replied six months later by proposing a plan in which the Government would provide funds if

Lockheed assumed over $480 million in losses and dropped its court case. At first, Lockheed rejected this proposal and said it would settle the issue in court. However, it soon became clear that the company's lack of cash flow was becoming critical. Also, extension of a very substantial line of bank credit was contingent upon settlement of the government disputes. With no other choice available, Lockheed accepted the government's proposal.

2. L-1011 "Tristar"

The losses on the four defense contracts had ramifications in other parts of the company as well. Half of the $400 million bank line of credit that was initially earmarked for the L-1011 airbus was diverted to cover cash shortages on the defense contracts. [Ref. 6, p. 8]

With such internal problems raging, the L-1011 ran into external troubles as well. It was encountering sharp competition from both the Boeing 747 and the McDonnell Douglas DC10. Both planes had beaten Lockheed to the market in the race for customers, although the 747, with its greater range and capacity, wasn't a direct competitor. In addition, the rate of growth in air travel started to fall off in the early seventies; and this hurt the sales of all three "jumbo jet" manufacturers.

The biggest blow to Lockheed came when Rolls-Royce, which was to produce the RB211 engine for the Tristar, declared bankruptcy. Apparently, Rolls-Royce had bid very low to get the contract against the stiff competition of General Electric and Pratt & Whitney. The British Government entered the picture and agreed to stand behind the operations of Rolls-Royce. However, Lockheed would have to incur increased costs for the engines - roughly $330 thousand

more per engine, or $1 million per plane. The British government also wanted a guarantee that Lockheed would actually buy all 555 engines.

Since Lockheed's finances were in a precarious position due to its defense contract disputes, the British wanted the United States Government to provide assistance to Lockheed. President Nixon on May 7, 1971 asked Congress for a loan guarantee for Lockheed, and a heated debate ensued that summer. The company based its claim for help on the following financial data: [Ref. 11, p. 24-25]

Cash and equivalent (Jan. 1, 1971)	$ 79 million
Line of credit remaining	$ 50 million
	$129 million
New Cash flow (Jan.-Jun. 1971)	$ 20 million
Use of credit remaining	($ 50) million
	$ 99 million
New cash flow (Jul.-Sept. 1971)	($ 91) million
Balance (Sept. 30, 1971)	$ 8 million
Lockheed's average monthly interest expense	$2.5 million
Lockheed's average monthly wages expense	$7.0 million

In addition, Lockheed's consortium of creditors said they would bar any new loans to the company without a government guarantee.

Reasons given by the White House for approval of the bill (Emergency Loan Guarantee Act) were the threatened unemployment of 30,000 people, economic losses affecting the U. S. GNP and California's GNP, complications in other Lockheed defense contracts (most notably the Trident, the S-3 and the SR-71), and the loss of a big competitor from the aerospace industry. [Ref. 11, pp. 32-43] Reasons brought forth by critics against passage of the bill focused on the dangers of manipulating the competitive system and the setting of a bad precedent. [Ref. 2]

Ostensibly, the Emergency Loan Guarantee Act was intended "to provide credit to large, well established and creditworthy enterprises"; [Ref. 11, p. 3] but, in fact, Lockheed was the sole applicant. Ultimately, the bill was approved by a vote of 49-48 in the Senate; and the Emergency Loan Board was set up in early August. This allowed Lockheed an additional $250 million in financing with which to continue development of its Tristar.

C. THE EARLY SEVENTIES

After the loan guarantee, fiscal years 1972 and 1973 were spent obtaining orders for the L-1011, filling orders for existing defense systems, working on the development of new systems for recently won contracts and drawing down the $250 million loan for work on the L-1011. By June 30, 1972, Lockheed had used $150 million. By December 1973 the total guaranteed loans had risen to $200 million.

Sales for the L-1011 were slow because of the drop in the rate of growth of air travel. In December 1973 Lockheed had kept pace with its competition with 199 orders and options. McDonnell-Douglas had 230 orders and options for its DC10. [Ref. 14, p. A21] Lockheed had earlier estimated a total market of 1,325 trijets by 1980, and it expected to get its share of that potential. [Ref. 15]

1. A New Crisis

By late 1973, the company claimed again to be in financial troubles and was looking for further financing, a merger partner, speed up of L-1011 deliveries, or some combination of the three. Lockheed's inventory was the only asset on its balance sheet that was rising substantially, and $959 million of the total $1,065 million in

inventory were associated with the L-1011. [Ref. 12, p. 12] Of this L-1011 inventory, over $137 million were deferred R&D costs and general and administrative expenses.[1]

Lockheed reported earnings of $15 million and $16 million in 1971 and 1972 respectively. Development costs which were included in inventories for the L-1011 in those two years were $82 million and $55 million respectively. [Ref. 16] Obviously, expensing R&D costs would severely affect Lockheed's earnings.

Also, while Lockheed claimed that, because of fewer models and a newer plant, its breakeven volume for the L-1011 was 300 planes (as compared to McDonnell-Douglas's estimate of 450 for its DC10), this low figure was questionable. [Ref. 14, p. A21] The company received a qualified opinion on its financial statements each year since 1970.

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[1] Lockheed isn't the only company which is deferring program development costs, however. McDonnell-Douglas is deferring such costs on the DC10. No other aerospace manufacturer is deferring development costs, but then no other has a large commercial venture which has not reached the break-even point.

III. THE SCOPE AND FOUNDATION OF THE THESIS

The assertion that Lockheed Aircraft Corporation was facing financial disaster in 1970 made headlines throughout the country and posed a potentially grave problem for the Department of Defense (DOD). Lockheed at that time was involved in the production of many weapons systems for the government. Its ranking as the largest defense contractor in fiscal years 1962-1966, 1969, and 1970 explain the reason for DOD's concern.

Lockheed ultimately received a $250 million loan guarantee from the United States Government. This thesis is an examination into whether Lockheed was headed for bankruptcy, as its management claimed. [Ref. 1] Financial ratios will be used exclusively in this examination.

This is not the first study of its kind. Several empirical studies have been conducted in an attempt to identify measures which can forecast the failure of an enterprise. Studies by Paul FitzPatrick, Arthur Winoker, Raymond Smith, and Charles Merwin all pointed out correlation between incipient failure and the relative values of selected financial ratios. [Ref. 18, p. 61] In addition, William Beaver's two studies in the late 1960's attempted to evaluate the ability of financial ratios to predict business failures.

A. BEAVER'S STUDIES

In a 1966 study, [Ref. 19] Beaver selected 79 insolvent companies and individually paired them with 79 solvent firms of similar asset size within their respective industries. He then performed certain tests on their ratios. All data used for the ratios were obtained from Moody's Industrial Manual. [Ref. 20]

Beaver first compared the means of financial ratios of the failed companies to those of their unfailed counterparts over a five-year time period. Using four a priori assumptions, he made predictions of the results of the paired comparisons of the means. His assumptions were: [Ref. 19. p. 80]

(1) The larger the reservoir of liquid assets, the smaller the probability of failure.
(2) The larger the net liquid asset flow from operations, the smaller the probability of failure.
(3) The larger the amount of debt outstanding, the greater the probability of failure.
(4) The larger the expenditures for operations as a percentage of sales, the greater the probability of failure.

Beaver selected six ratios on which to base his predictions. This choice of ratios was made on the basis of popularity in current literature, strong performance in previous studies, and the growing importance being given to the funds flow concept. His ratios and predictions were as follows: [Ref. 19, p. 81]

RATIO	PREDICTION
Funds flow to total debt	Nonfailed > Failed
Net income to total assets	Nonfailed > Failed
Total debt to total assets	Failed > Nonfailed
Working capital to total assets	Nonfailed > Failed
Current ratio	Nonfailed > Failed
No-credit interval	Nonfailed > Failed

The actual results confirmed Beaver's predictions.

> ...the difference in the mean values is in the predicted direction for each ratio for all five years before failure. Failed firms not only have a lower cash flow than nonfailed firms but also a smaller reservoir of liquid assets. Although the failed firms have less capacity to meet obligations, they tend to incur more debt than do nonfailed firms. [Ref. 19, p. 80]

A graph of the means of nonfailed firms versus time before failure shows that the trend line connecting the plotted points has a zero slope. Yet, the trend in the means of the failed firms has a marked deterioration and slope. This difference is noticeable five years before failure. Plotting both the failed and unfailed companies' means on the same graph shows that the difference in means increases as the year of failure approaches.

> The data demonstrate a substantial degree of consistency. The evidence overwhelmingly suggests that there is a difference in failed and unfailed firms. Since the means used in this comparison had a non-normal distribution, however, no conclusion could be drawn from the comparison of the means. [Ref. 19, p. 81]

Therefore, Beaver then used a dichotomous classification test to make a prediction of a company's success or failure. In this test, Beaver arranged all the values of the individual financial ratios in ascending order. The array was inspected and a separation point was selected. Beaver then assumed that the means of the failed firms were on one side of the separation point and those of the unfailed firms on the other side. This separation point is selected so as to minimize the percentage of incorrect classifications. He then calculated the number of misclassifications. That is, if he assumed a firm to be failed (nonfailed) and it was nonfailed (failed), a misclassification ensued. The results of the dichotomous classification test approximate what the mean comparisons had already shown.

> The ability to predict failure is strongest in the cash flow to total debt ratio... ←

> Clearly all ratios do not predict equally well. The net income to total assets ratio predicts second best, which is to be expected since its correlation with the best ratio is higher than the correlation of any other ratio with the best ratio. The total debt to total asset ratio predicted next best, with the three liquid asset ratios performing least well. [Ref. 19, p. 85-86] ←

In a 1968 study, Beaver reported on a continuation of his previous work. Some conclusions drawn in this report were that the non-liquid asset measures predict failure better than the liquid asset measures, even in the years immediately before failure, and that the two less frequently advocated liquid asset measures (working capital and cash) outperform the two frequently advocated ones (current assets and quick assets). [Ref. 21, p. 121]

B. DASCHER'S STUDY

With Beaver's studies as a starting point, Dascher attempted to analyze the Penn Central Railroad bankruptcy after the fact. Since Penn Central had undergone a merger two years before bankruptcy, data for the study were obtained from the years 1968 and 1969 only. Dascher based his study on Beaver's results, which suggest that, when the values of relevant ratios are below established levels, the company is headed for financial trouble. "The more significant the difference from acceptable levels, the greater the potential for failure." [Ref. 18, p. 63]

Dascher used the means of the financial ratios of nine other railroads as the established level. He used the nine other railroads in the sample to estimate the parameters of a normal distribution. He then could compute the probability of an observation, at least as extreme as the Penn Central value, given an observation from the same normal distribution; this probability is called the level of significance. [Ref. 18, p. 63] The smaller the level of significance, the higher is the confidence that significant differences do in fact exist between Penn Central and the industry sample. A low level of

significance prevailed. With this information, he concluded that the Penn Central's failure, in hindsight, was not improbable.

Also in his study, Dascher ranked the relevant ratios of all the railroads for the two years, and he computed the average of these rankings. Penn Central's overall rank did improve in 1969 compared with 1968. However, the average of the ranks of the most important indicators, the non-liquid asset ratios, didn't follow the overall average and actually were worse in 1969. Penn Central's rank for the two years was consistently low; only once did any ratio reach the fifth position or better. Dascher also performed a correlation coefficient test for the rankings between years 1968 and 1969 and a high correlation coefficient resulted. These results further support Dascher's conclusion.

C. THE PRESENT STUDY

The current study is based on the work of both Beaver and Dascher, but it is closer in format to Dascher's study. The ratios used by Dascher plus two others (working capital flow/total debt and net monetary assets flow/total debt) will be employed in this study. All data used in the computation of the financial ratios were obtained from Moody's Industrial Manual. A sample of ten aircraft manufacturing firms will comprise the comparative group of this study. A mean for each ratio of these ten companies will then be compared to the corresponding ratio of the Lockheed Aircraft Corporation. In addition, a ranking of the ratios will be performed. The results will then be viewed for the five-year interval leading up to the emergency

loan guarantee in 1971. A similar analysis will also be conducted for the years 1971-1972, as Lockheed claims that it again faces financial crises. [Ref. 3] The dichotomous classification test will not be used because, as in Dascher's study, there is only one "failed" firm. The significance test that Dascher performed will be omitted since the assumption of normality does not apply.

IV. DATA PRESENTATION

Due to the successful predictive results of Dascher's study [Ref. 18] and Beaver's 1968 study [Ref. 21], the same ratios were chosen for this analysis with two additional ratios that were deemed appropriate. As mentioned in a previous chapter, the extra two ratios are the working capital flow/total debt ratio and the net monetary assets flow/total debt ratio. The former is defined as the change from year to year in the difference between current assets and current debt divided by the total debt of the later year. The latter is defined as the change in the difference between quick assets and current debt from one year to the next divided by the total debt of the later year.

Both were chosen because of the increased use being made of the funds flow concept. The working capital flow/total debt was specifically added because it was felt that this ratio would more succinctly demonstrate how the firm was taking on added debt and also as a comparison to the funds flow from operations/total debt ratio. The net monetary assets flow/total debt was included in order to observe how Lockheed's increase in inventory effects the working capital flow/total debt ratio.

A. FOURTEEN BASIC RATIOS

The financial measures that are used in the calculation of the remaining fourteen ratios are defined in Table I.

Table I

MEASURE	DEFINITION
net income	total earnings from operations
total assets	the sum of all assets a company owns
total debt	both long-term and short-term liabilities of a company plus certain deferrals (e.g. taxes)
current assets	those assets which will be realized in one year or one operating cycle, whichever is longer
quick assets	current assets minus inventory and prepaid expenses
current debt	those liabilities whose liquidation reasonably requires the use of current assets or other current liabilities
working capital	current assets-current liabilities
cash	cash and marketable securities
sales	the revenue of a company during a specific year
funds flow from operations	net income plus depreciation and amortization

The two additional ratios chosen for this study plus the ratios derived from the Table I measures are as follows:

#1. Working capital flow/total debt
#2. Net monetary assets flow/total debt
#3. Funds flow/total debt
#4. Net income/total assets
#5. Total debt/total assets
#6. Current assets/total assets
#7. Quick assets/total assets
#8. Working capital/total assets
#9. Cash/total assets
#10. Current assets/current debt
#11. Quick assets/current debt

- #12. Cash/current debt
- #13. Current assets/sales
- #14. Quick assets/sales
- #15. Working capital/sales
- #16. Cash/sales

Ratios #13, #14, #15, and #16 will be collectively called 'turnover ratios'.

Beaver, in his 1968 study, categorized the ratios he was using into liquid asset ratios and non-liquid asset ratios. Liquid asset ratios are those which are generally regarded as indicators of short-term solvency. Likewise, non-liquid asset ratios are measures of long-term solvency. Therefore, Beaver's 14 ratios can be subdivided into two groups, liquid asset ratios and non-liquid asset ratios, according to whether they are long or short term predictors. [Ref. 21, p. 114] Ratios #3, #4, and #5 are non-liquid asset ratios and ratios #6 thru #16 are liquid asset ratios.

Funds flow from operations/total debt can be viewed as either liquid or non-liquid. However, since Beaver concluded that this ratio is a measure of long-term solvency, he listed it as a non-liquid asset ratio. [Ref. 21, p. 114] As the two added ratios were not included in earlier studies, they will not be categorized as either liquid or non-liquid.

B. THE FIRMS IN THE STUDY

The list of firms chosen as the sample to be compared with Lockheed were those aerospace/defense companies that could be found in Moody's Industrial Manual. [Ref. 20] The firms are listed in Table II.

Table II

FIRMS

#1. Boeing Company
#2. Curtiss-Wright Corporation
#3. General Dynamics Corporation
#4. Grumann Corporation
#5. LTV Aerospace Corporation
#6. McDonnell-Douglas Corporation
#7. Northrup Corporation
#8. Rockwell International Corporation
#9. Teledyne, Inc.
#10. United Aircraft Corporation

All financial data used in the analysis come from their financial statements as listed in Moody's. In the case of LTV Aerospace, data were not presented for 1971 and 1972. In the case of Rockwell International, consolidated statements for the years 1966 and 1967 weren't given and, therefore, the company wasn't included in the calculations of those years.

All firms are principally involved in the aerospace industry. Some produce a whole airframe. Some produce only parts of an airframe. In the former group are Boeing, General Dynamics, Grumann, LTV Aerospace, McDonnell-Douglas, Northrup, Rockwell International, and United Aircraft, in addition to Lockheed. In the latter group are Curtiss-Wright and Teledyne.

Several companies have diversified into other fields, but still a major portion of each selectee's business is in aviation construction; and all sell to the Department of Defense. Since the sample includes only ten firms which were not randomly selected and since there is only a small population, the assumption of normality cannot be made. Unlike Dascher's, this study will not use statistical methods based on the assumption of normality.

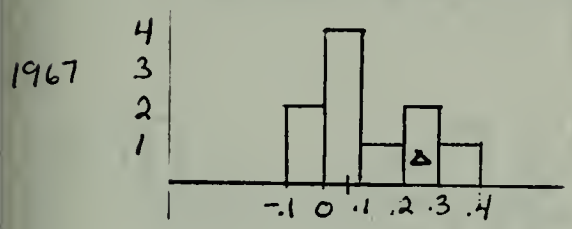
C. DATA

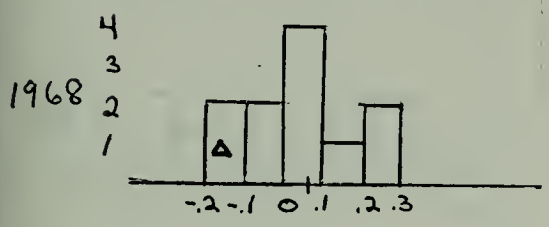
Financial data for all of the firms used in the study are listed in Appendix A. With these data, the ratios were calculated for each company and are included in Appendix B. The means and standard deviations of the financial ratios for the ten comparative firms and the comparable ratios for Lockheed are also reported in Appendix B. All the financial ratios are graphed by year in histogram form with the mean and standard deviation included. Lockheed's position is indicated by a delta (Δ). These histograms are displayed below in Figures 1 thru 16. The histograms for each ratio are arranged so that the successive means of the ten comparative companies are aligned vertically. Histograms for the five years preceding the loan guarantee (1966-1970) appear on the left side of each figure and those for 1970 plus the two years after the loan guarantee appear on the right side. The histogram for 1970 is repeated in order to depict graphically the effect that the loan may have had on the ratios of the subsequent two years. The means of the financial ratios of the industry are then compared to Lockheed's financial ratios in graphic form (Figures 17 thru 32).

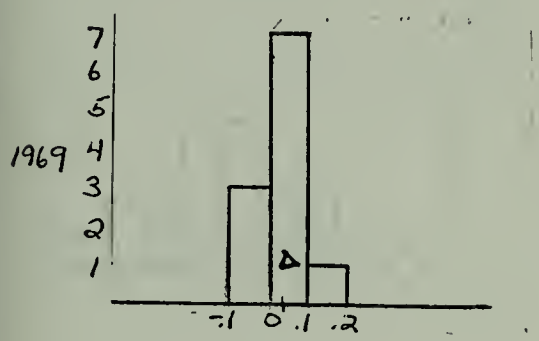
The eleven firms were ranked according to their respective values for each of the sixteen ratios for each year in the study. In each case, the highest ranking indicates the most favorable ratio value and the lowest ranking, the weakest value for that ratio. There are eleven places in the ranking for 1968, 1969, and 1970. In 1966 and 1967 and again in 1971 and 1972, however, there are only ten places because of the absence of data for Rockwell International and LTV Aerospace, as explained above. Table III shows Lockheed's ranking by each ratio in each year. It also shows Lockheed's rank according to the average ranking for all ratios and for the three non-liquid asset ratios.

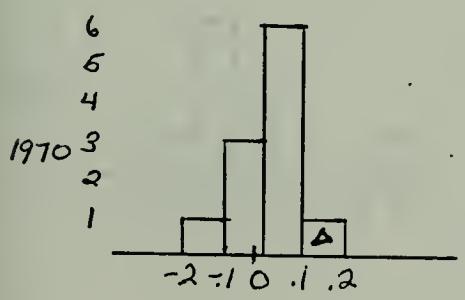
Ratio #1 Working Capital Flow/Total Debt

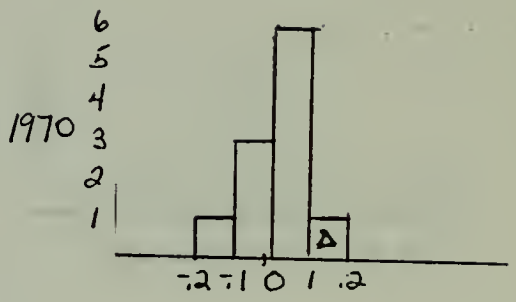
Figure 1

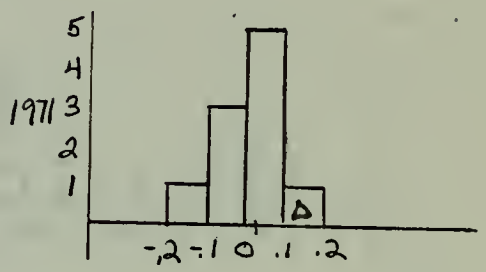


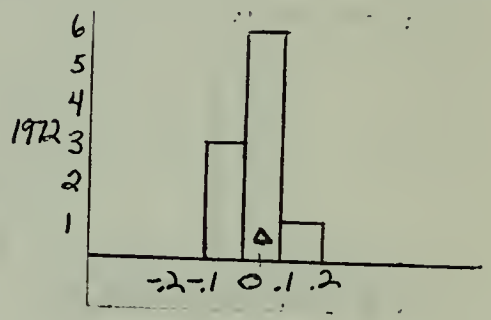






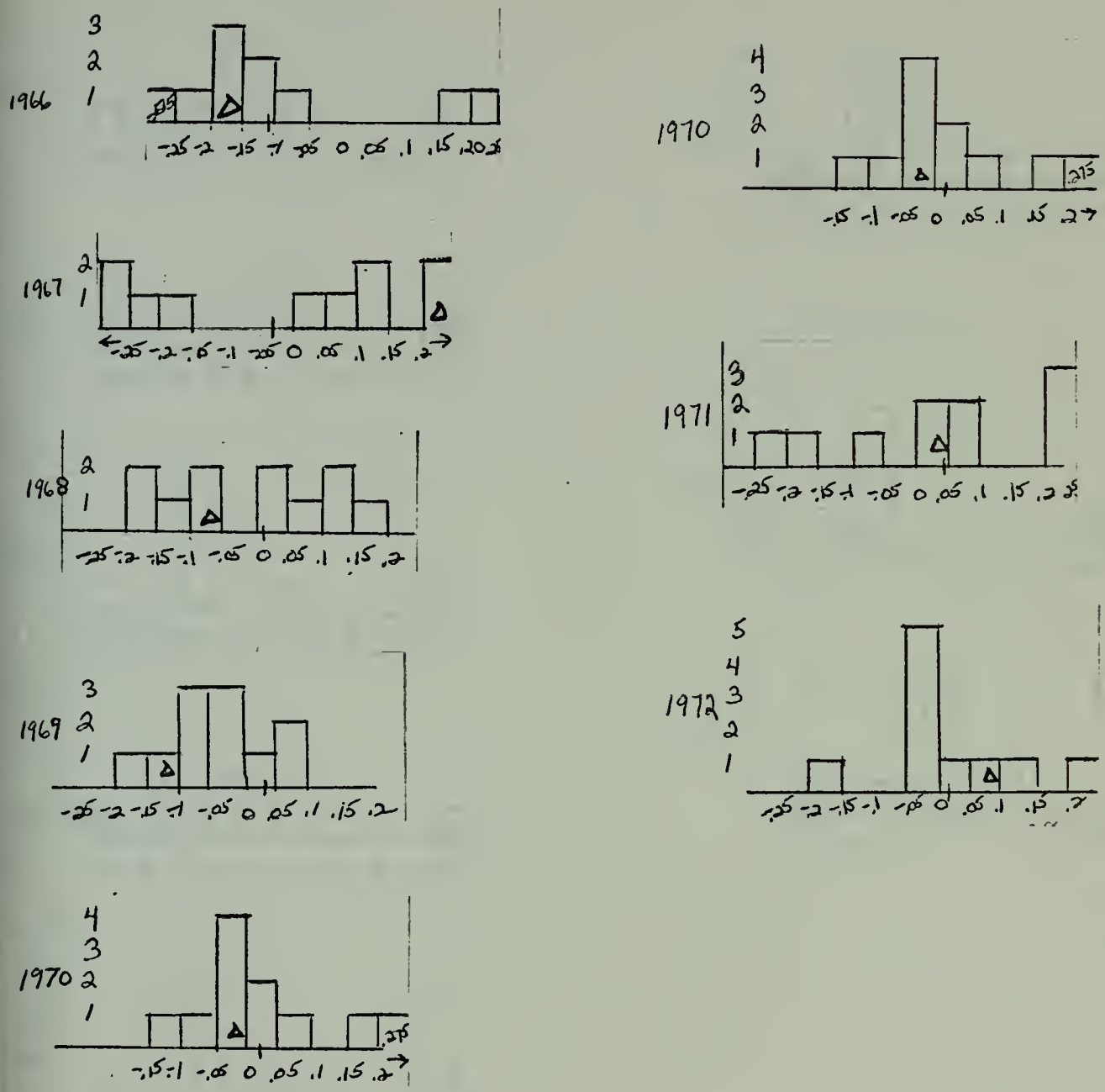






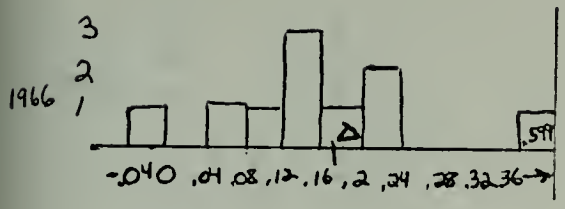
Ratio #2 Net Monetary Assets Flow/Total Debt

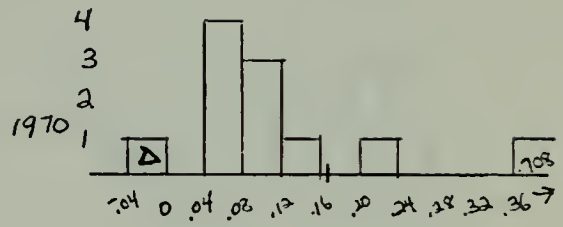
Figure 2

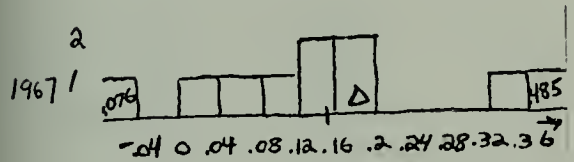


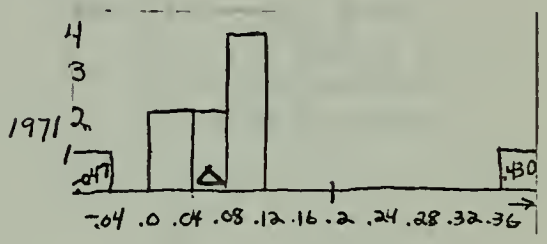
Ratio #3 Funds Flow/Total Debt

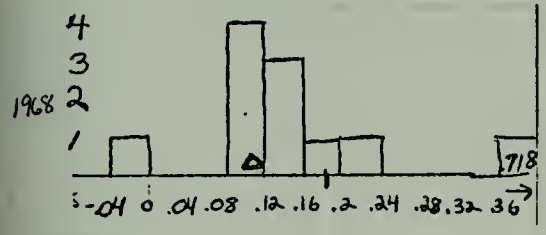
Figure 3

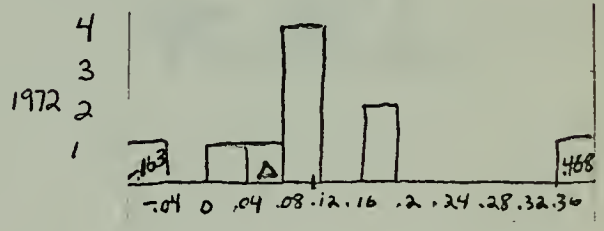


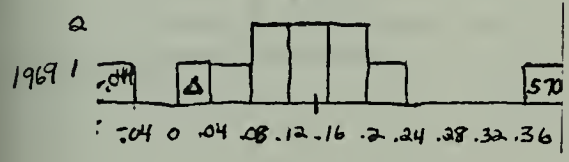


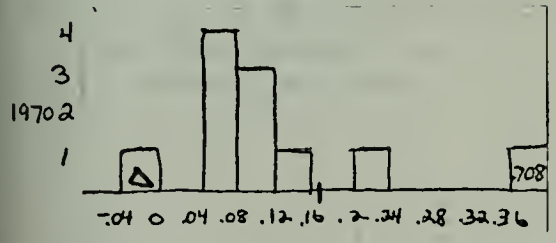






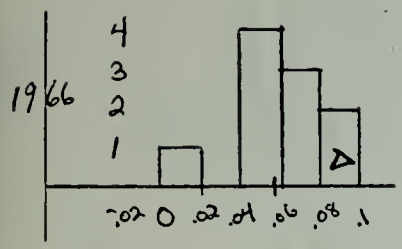


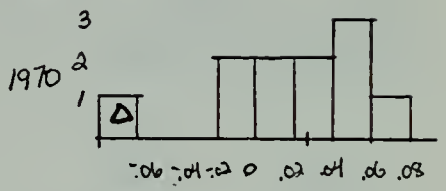


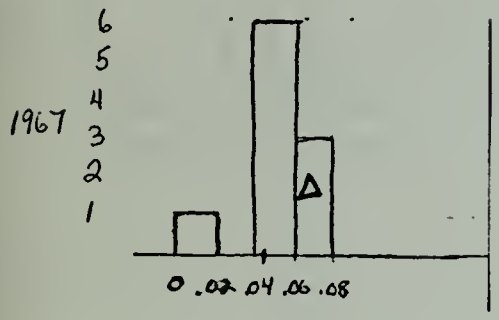


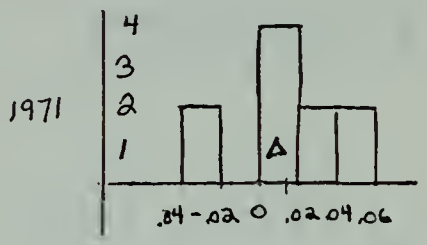
Ratio #4 Net Income/Total Assets

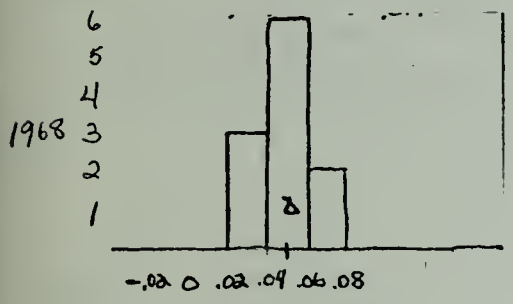
Figure 4

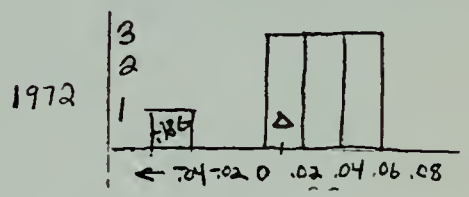


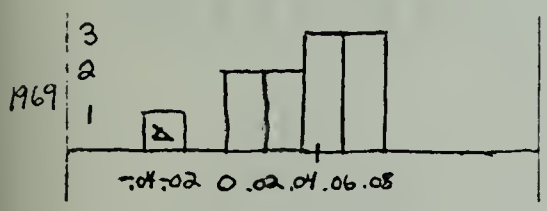


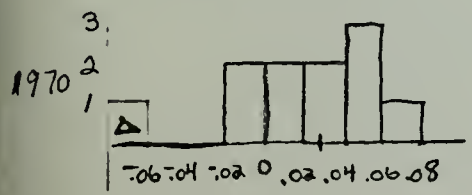






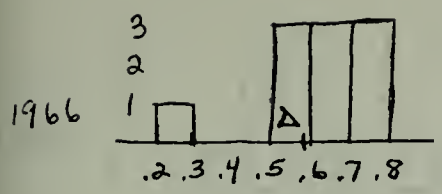


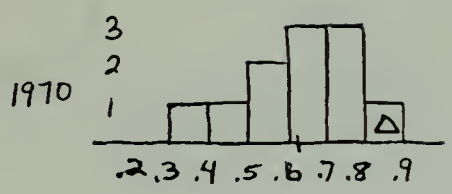


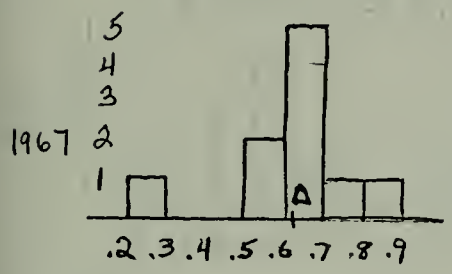


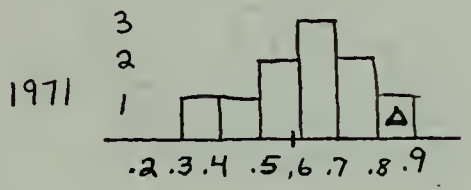
Ratio #5 Total Debt/Total Assets

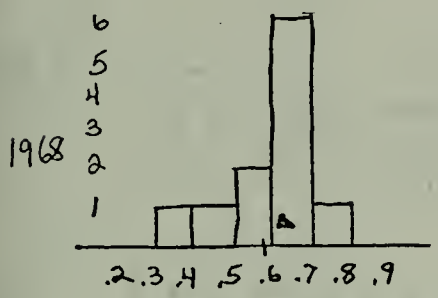
Figure 5

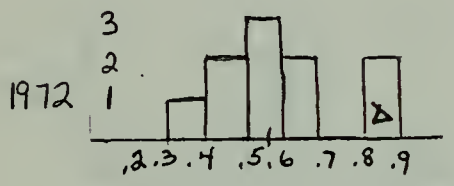


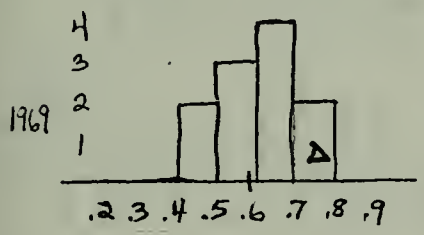


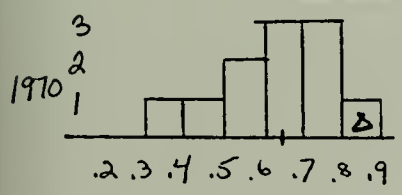






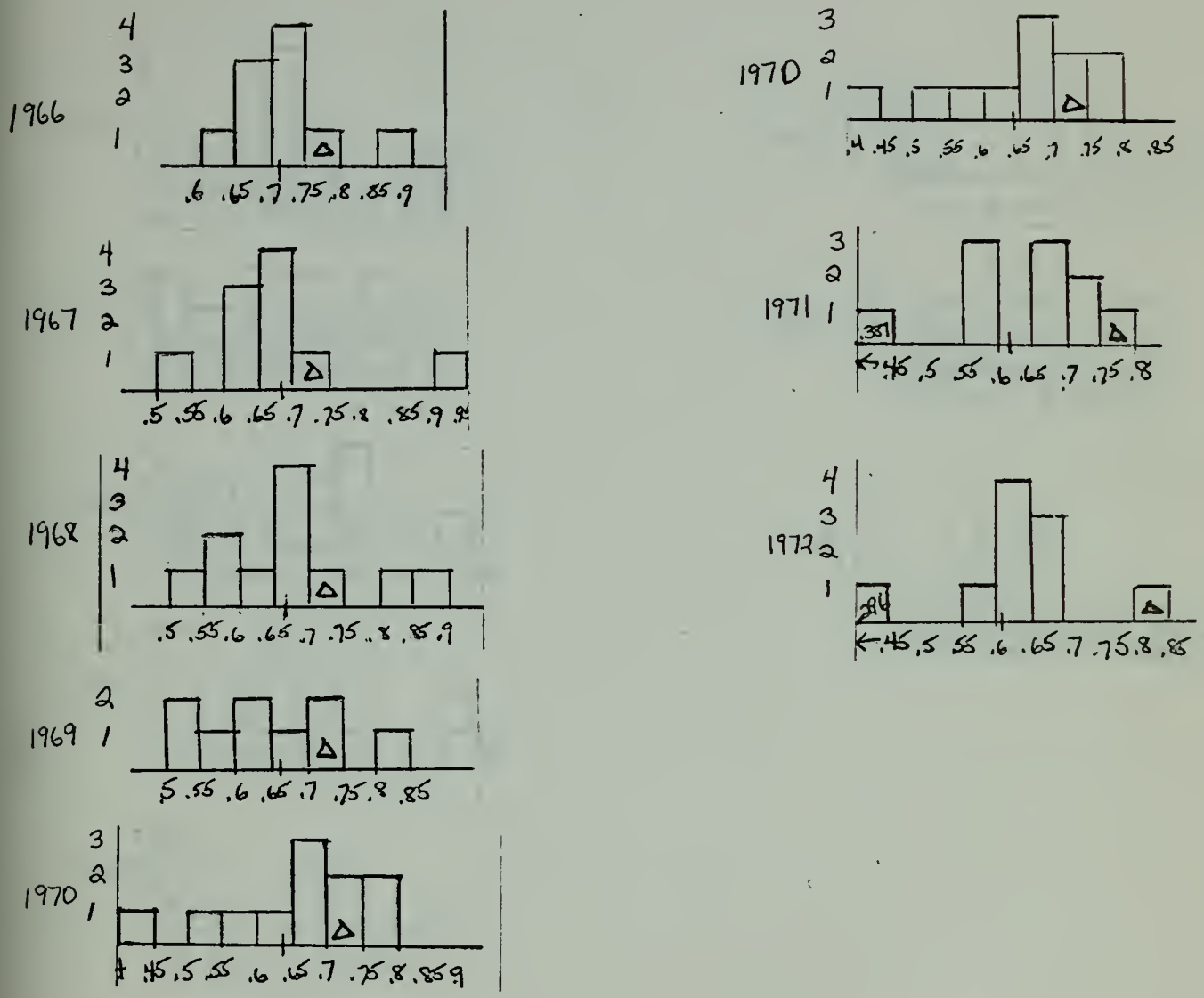






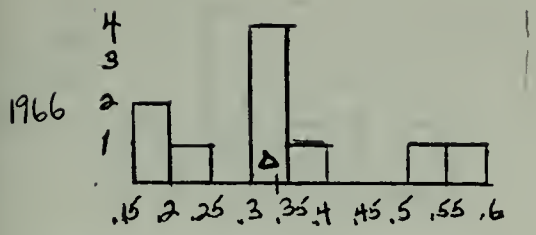
Ratio #6 Current Assets/Total Assets

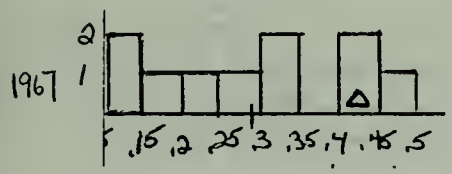
Figure 6

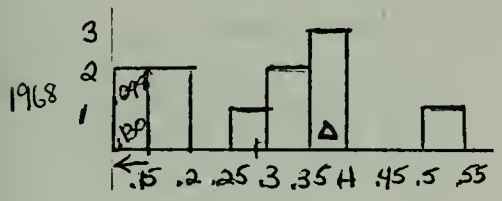


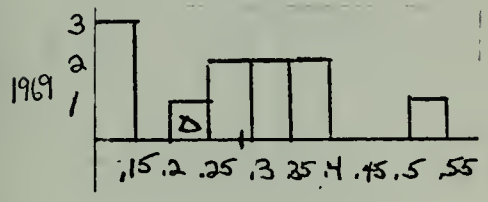
Ratio #7 Quick Assets/Total Assets

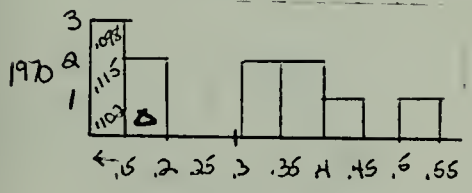
Figure 7

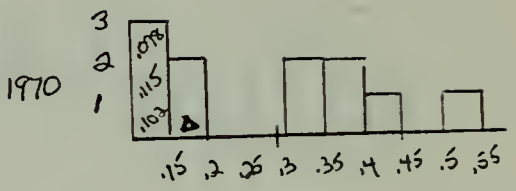


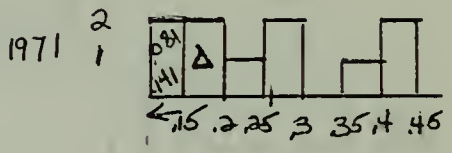


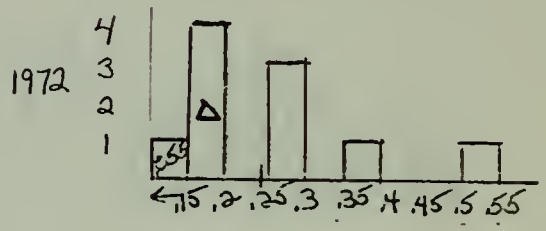






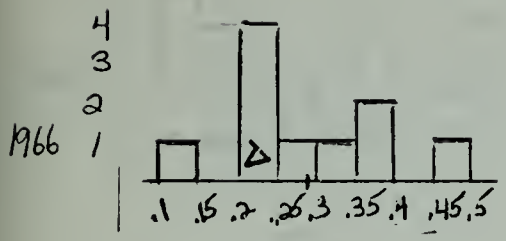


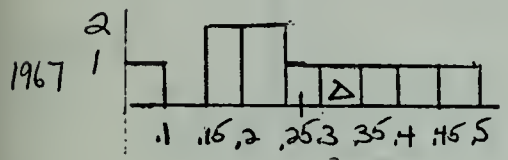


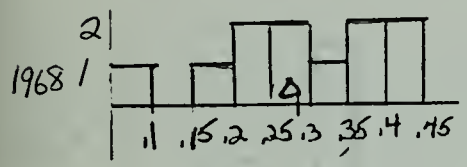


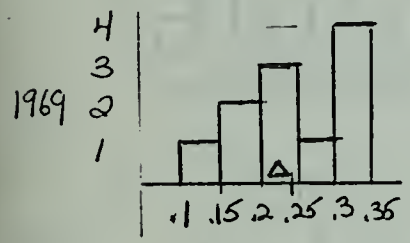
Ratio #8 Working Capital/Total Assets

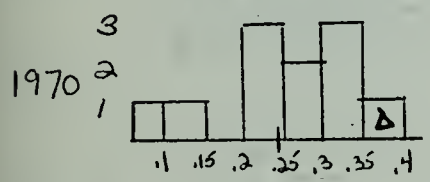
Figure 8

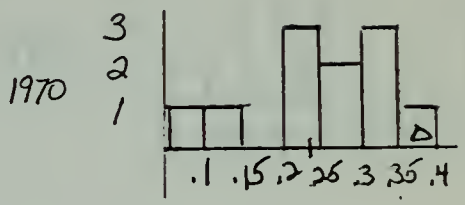


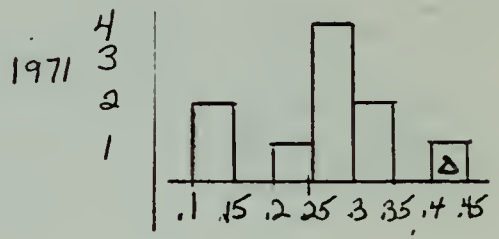


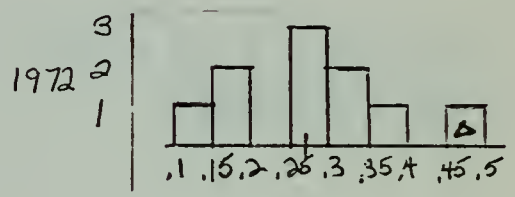






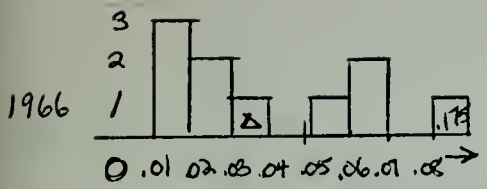


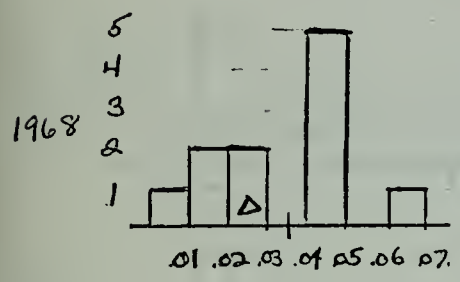


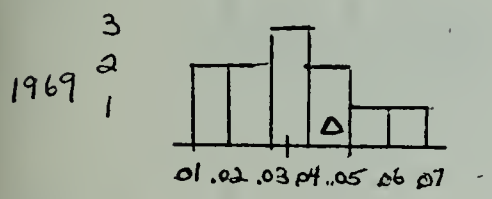


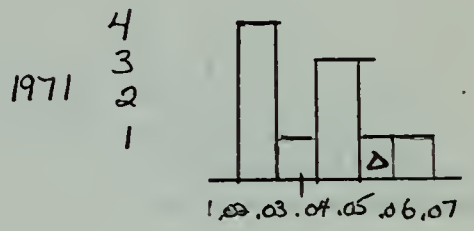
Ratio #9 Cash/Total Assets

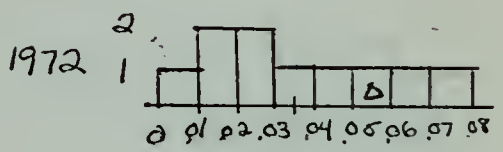
Figure 9





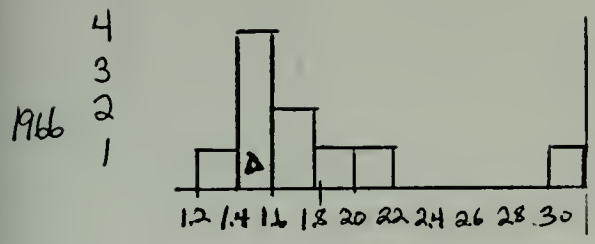


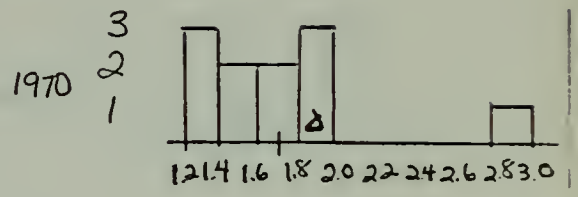


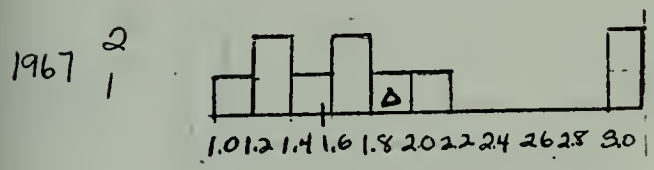


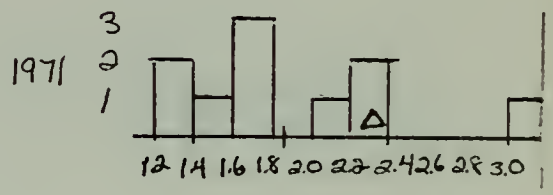
Ratio #10 Current Assets/Current Debt

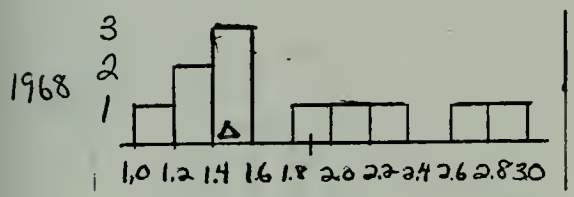
Figure 10

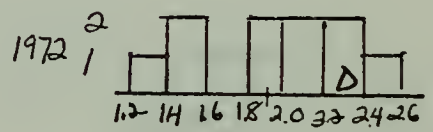


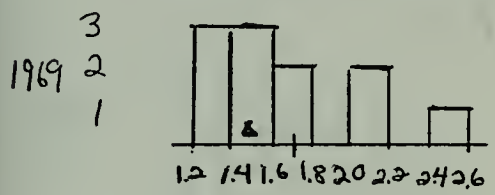


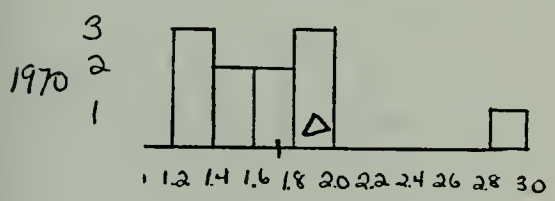






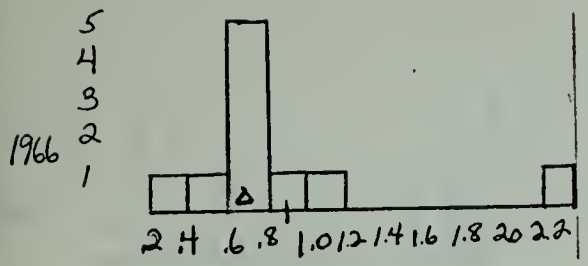


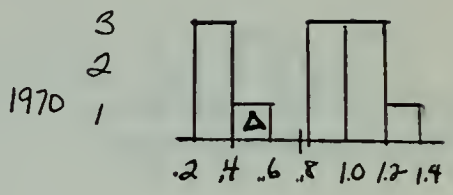


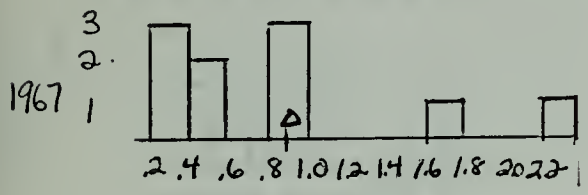


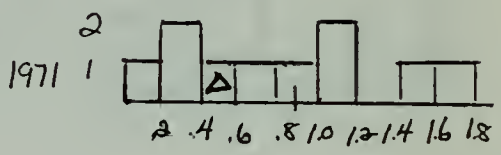
Ratio #11 Quick Assets/Current Debt

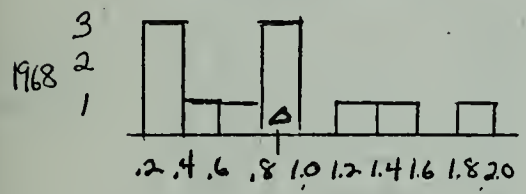
Figure 11

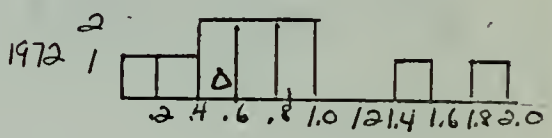


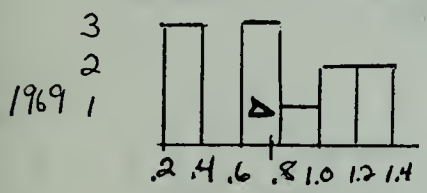


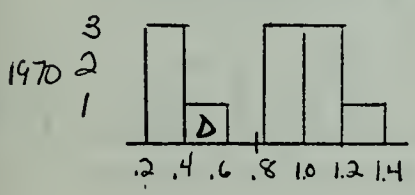






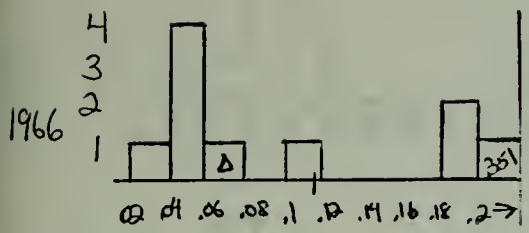


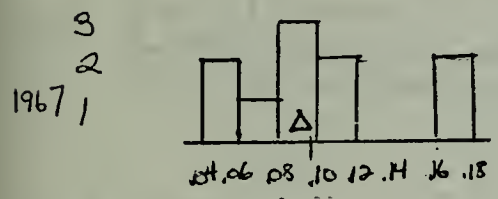


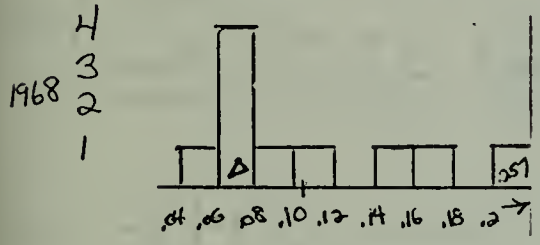


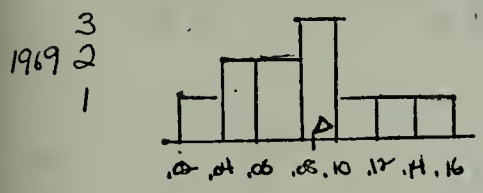
Ratio #12 Cash/Current Debt

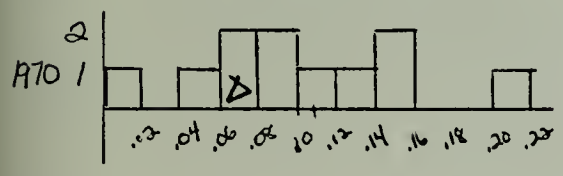
Figure 12

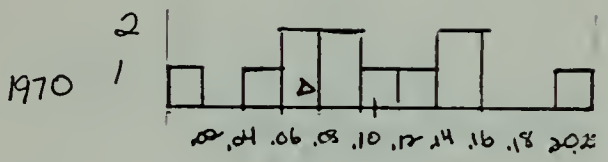


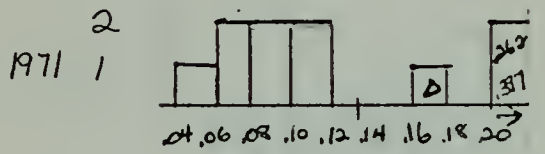


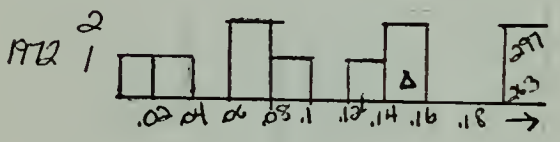






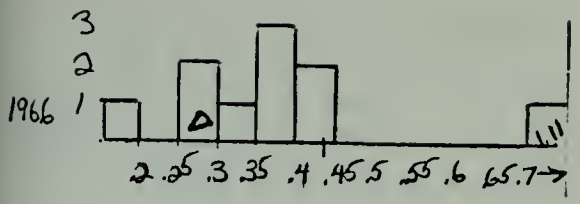


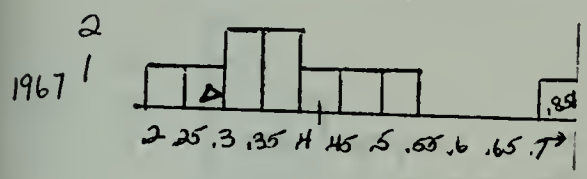


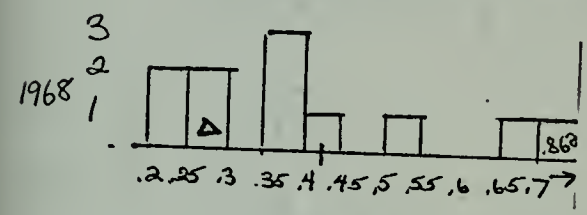


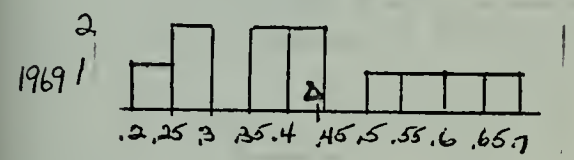
Ratio #13 Current Assets/Sales

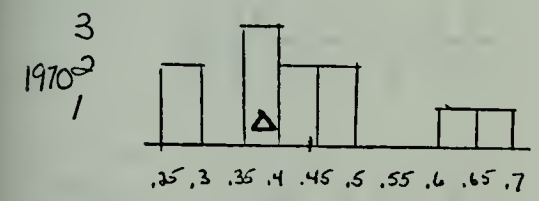
Figure 13

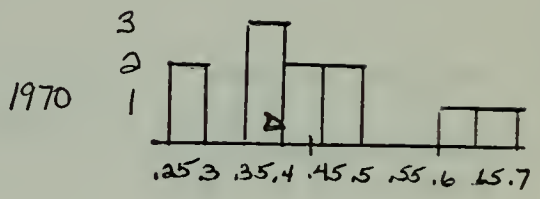


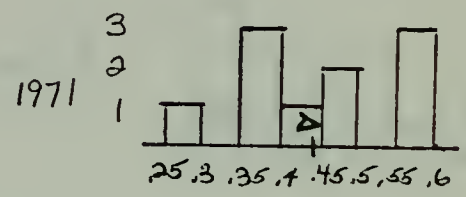


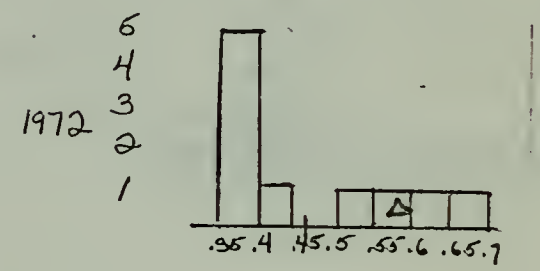






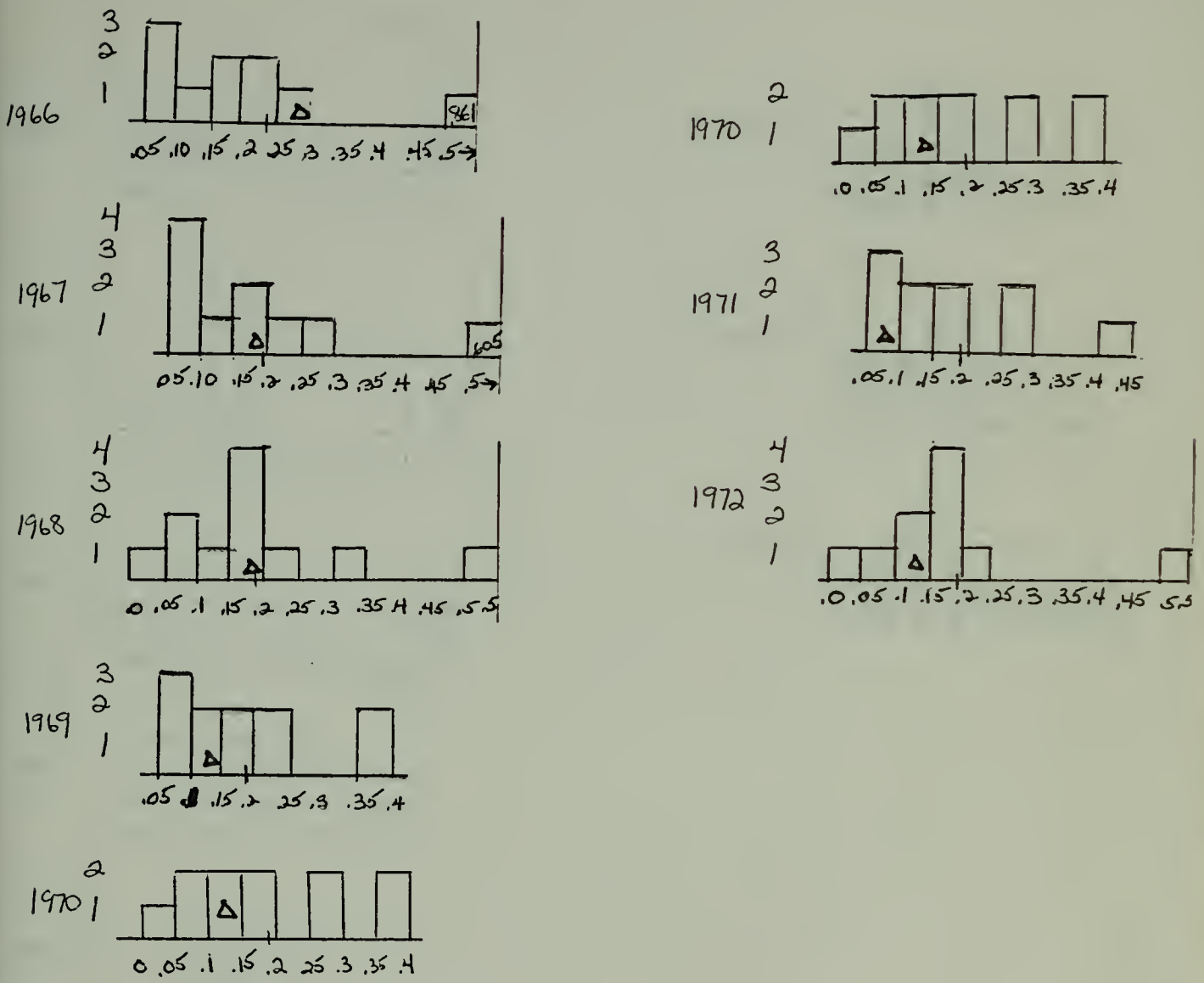






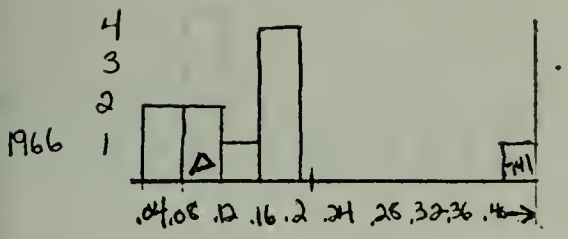
Ratio #14 Quick Assets/Sales

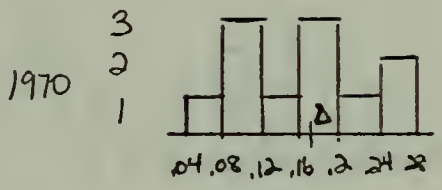
Figure 14

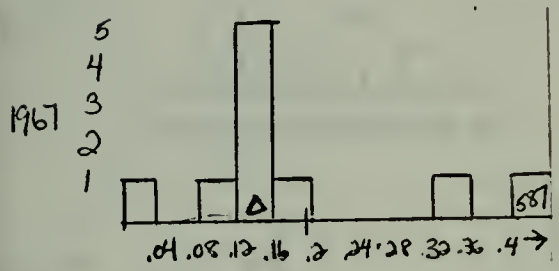


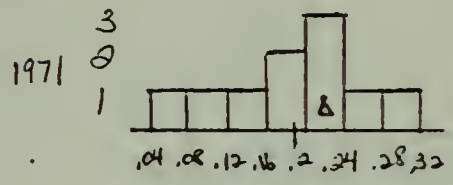
Ratio #15 Working Capital/Sales

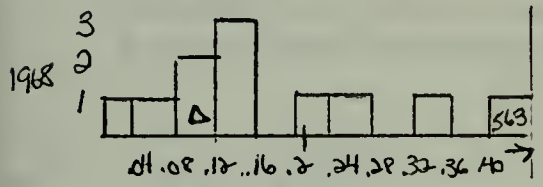
Figure 15

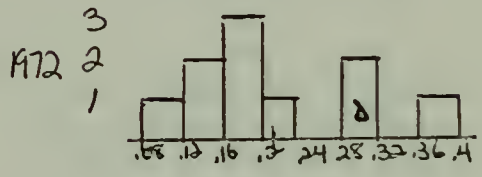


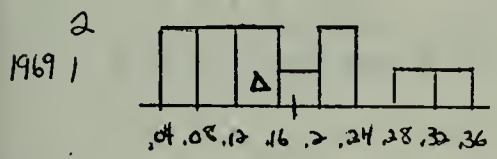


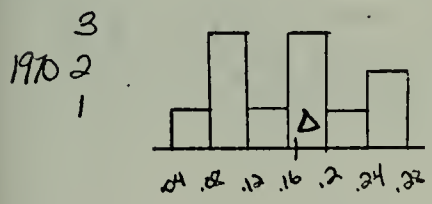






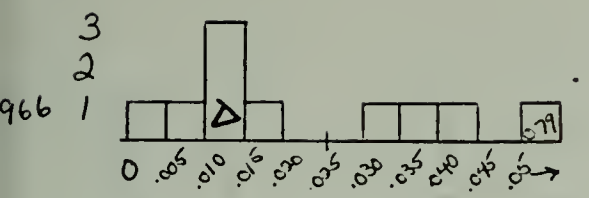


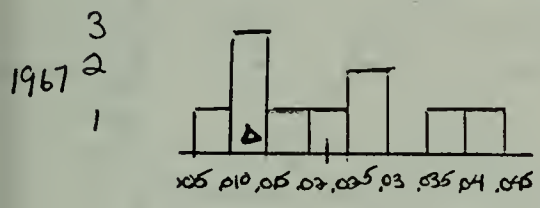


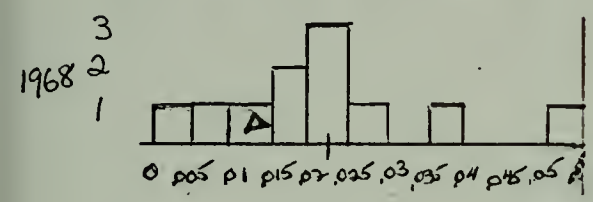


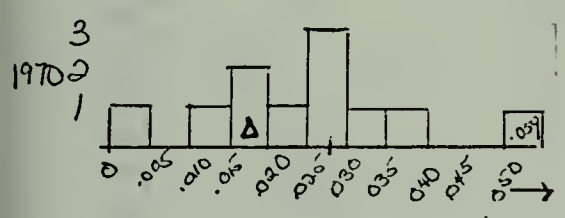
Ratio #16 Cash/Sales

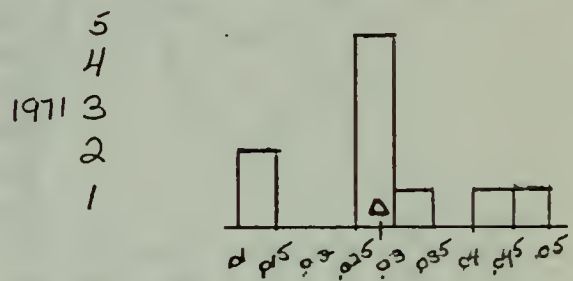
Figure 16



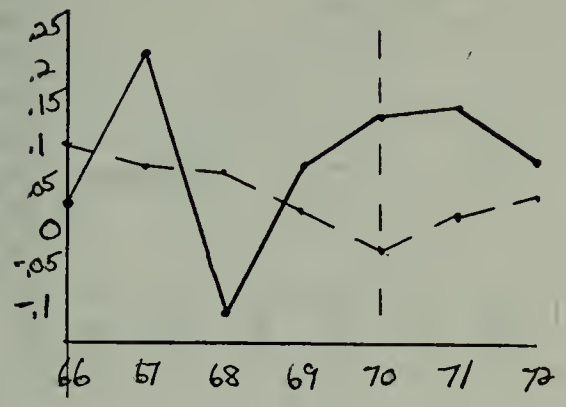




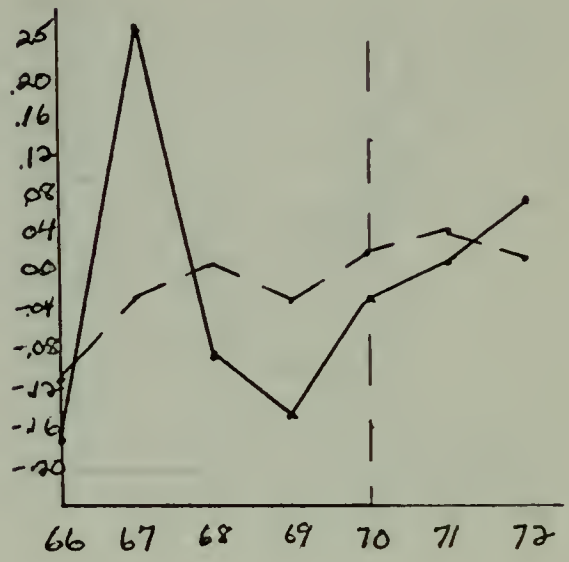




Ratio #1
Working Capital Flow/Total Debt
Figure 17



Ratio #2
Net Monetary Assets Flow/Total Debt
Figure 18



LOCKHEED - - -
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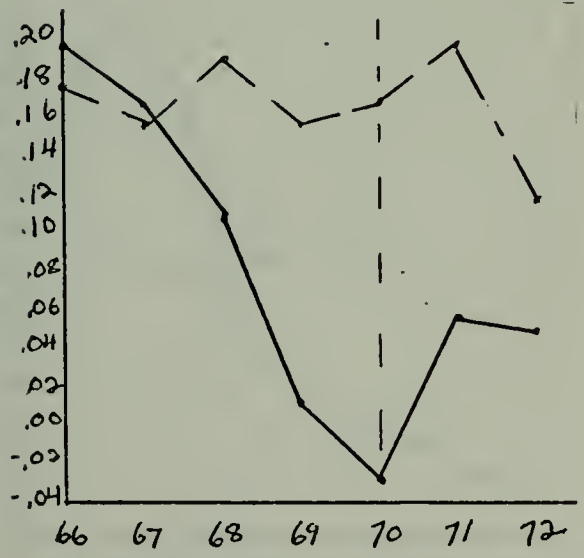
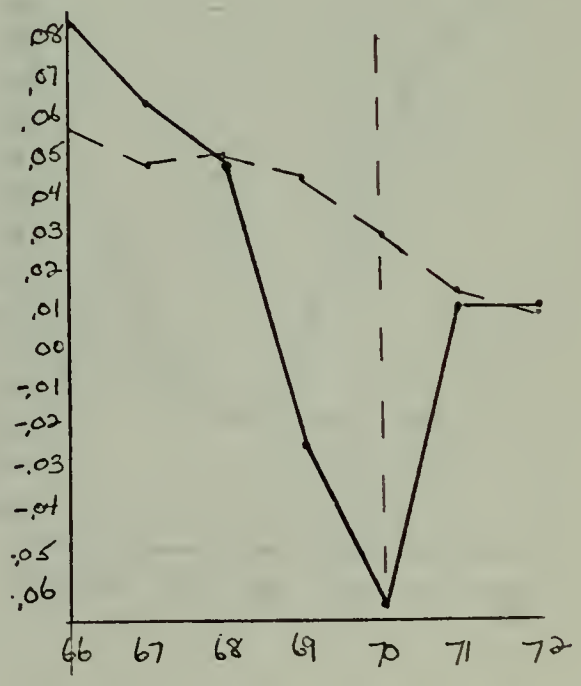
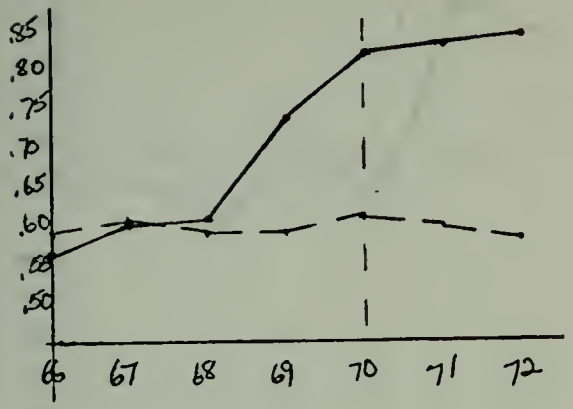
Ratio #3
Funds Flow/Total Debt
Figure 19



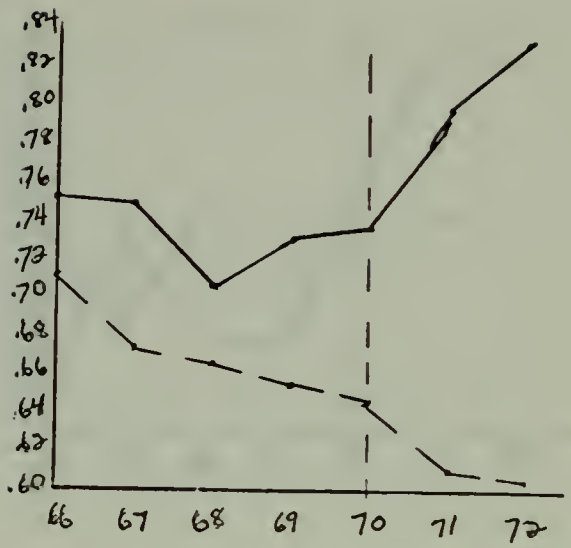
Ratio #4
Net Income/Total Assets
Figure 20



Ratio #5
Total Debt/Total Assets
Figure 21

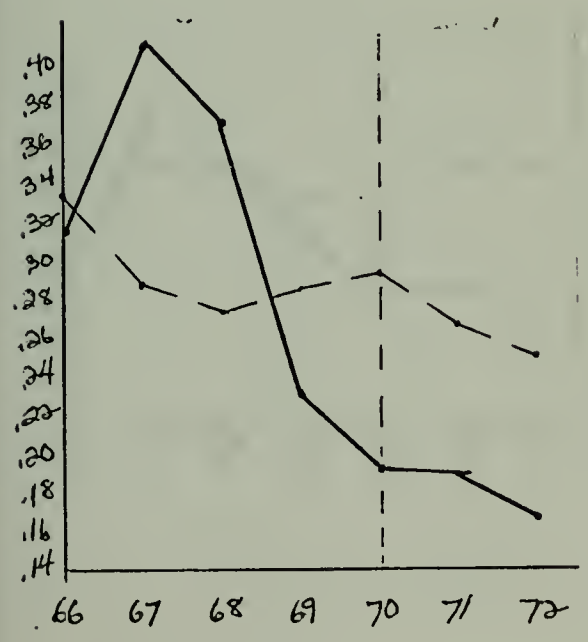


Ratio #6
Current Assets/Total Assets
Figure 22

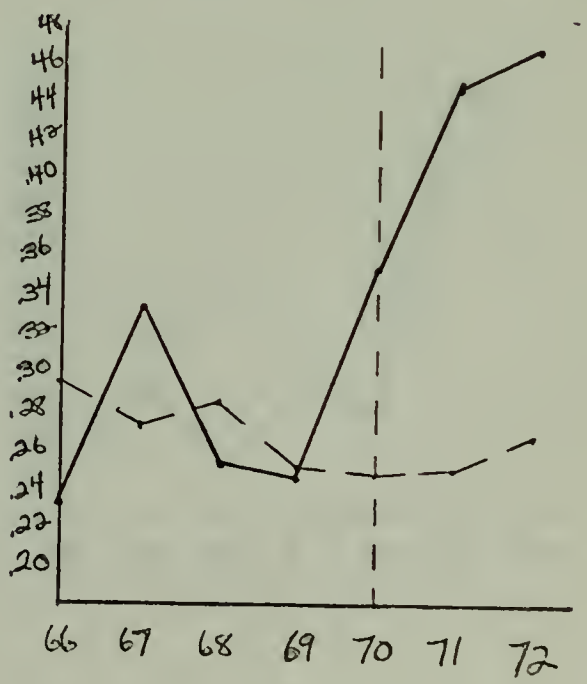


LOCKHEED ----
INDUSTRY MEAN ——

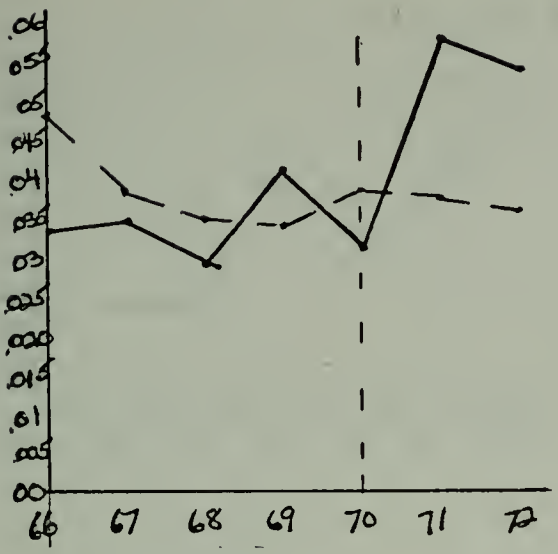
Ratio #7
Quick Assets/Total Assets
Figure 23



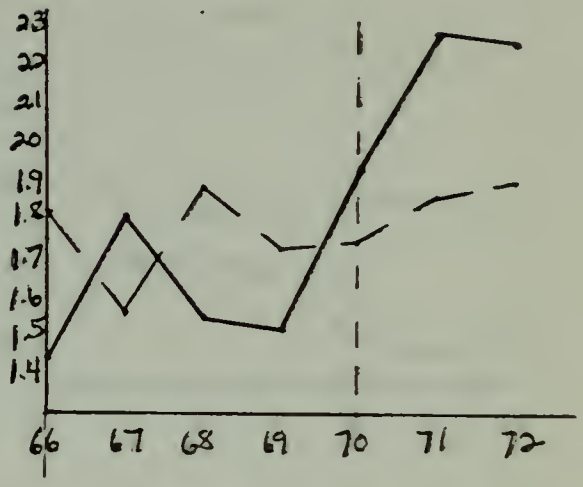
Ratio #8
Working Capital/Total Assets
Figure 24



Ratio #9
Cash/Total Assets
Figure 25

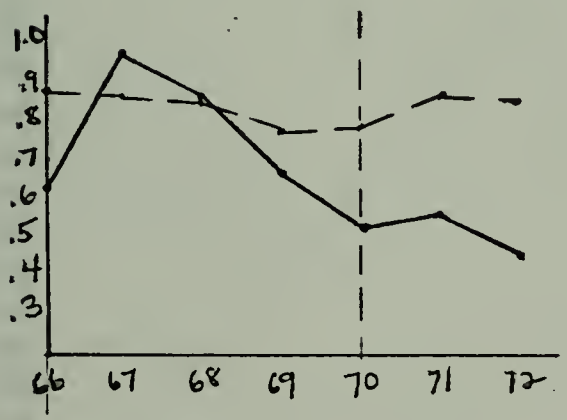


Ratio #10
Current Assets/Current Debt
Figure 26

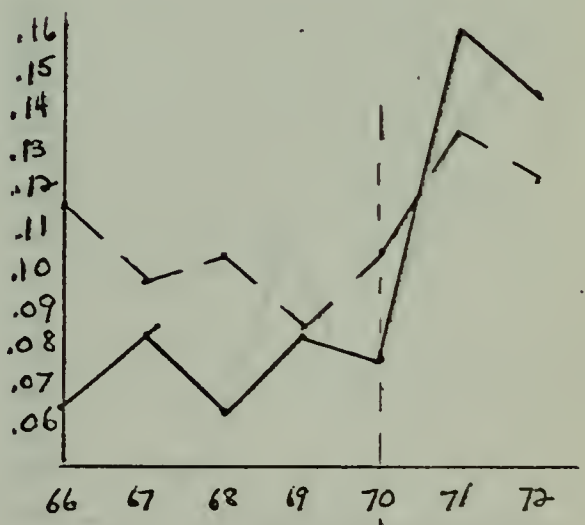


LOCKHEED ----
INDUSTRY MEAN ——

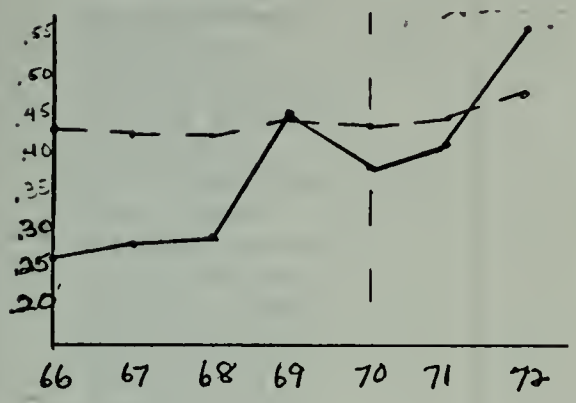
Ratio #11
Quick Assets/Current Debt
Figure 27



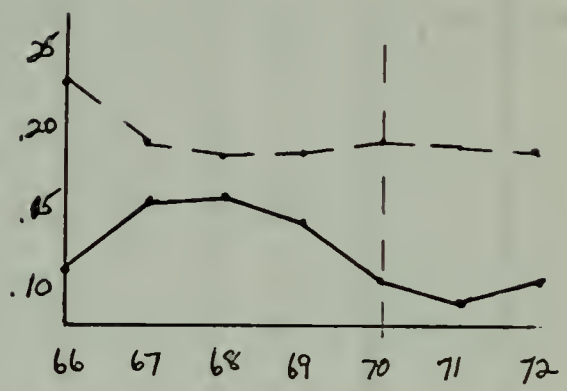
Ratio #12
Cash/Current Debt
Figure 28



Ratio #13
Current Assets/Sales
Figure 29

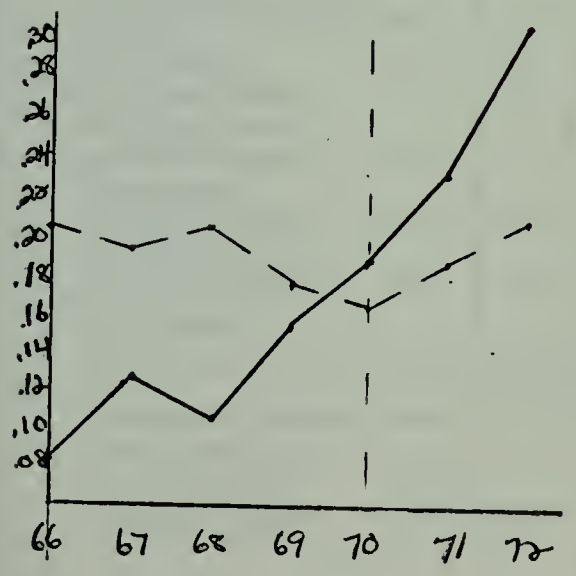


Ratio #14
Quick Assets/Sales
Figure 30



LOCKHEED ----
INDUSTRY MEAN ——

Ratio #15
Working Capital/Sales
Figure 31



Ratio #16
Cash/Sales
Figure 32

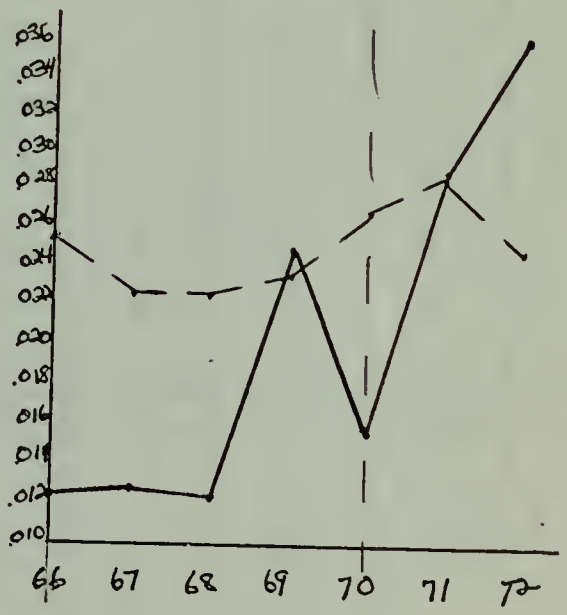


Table III

Rankings of Lockheed by Ratios

	1966	1967	1968	1969	1970	1971	1972
#1 Working Capital Flow/ Total Debt	6	3	10	2	1	1	3
#2 Net Monetary Assets Flow/ Total Debt	7	2	8	10	9	7	3
#3 Funds Flow/ Total Debt	4	4	7	10	11	7	8
#4 Net Income/ Total Assets	2	3	6	11	11	6	9
#5 Total Debt/ Total Assets	3	4	5	11	10	10	10
#6 Current Assets/Total Assets	2	2	3	3	3	1	1
#7 Quick Assets/ Total Assets	6	3	3	8	8	7	7
#8 Working Capital/Total Assets	7	4	7	6	1	1	1
#9 Cash/Total Assets	5	6	7	4	7	2	3
#10 Current Assets/Current Debt	9	4	7	7	4	2	3
#11 Quick Assets/Current Debt	8	3	5	7	8	7	8
#12 Cash/ Current Debt	5	7	9	6	8	3	4
#13 Current Assets/Sales	2	2	3	6	3	5	8
#14 Quick Assets/Sales	3	5	4	4	3	2	2
#15 Working Capital/Sales	2	4	3	5	5	6	8
#16 Cash/ Sales	4	3	2	6	2	5	7
Overall Average	4.68	3.68	5.56	6.62	5.93	4.56	5.37
Average for Non-Liquid Asset Ratios	3.0	3.67	6.0	10.67	10.67	7.33	9.0

V. ANALYSIS AND CONCLUSIONS

Beaver's two studies and Dascher's study were the principal building blocks upon which this thesis was based. All three works have shown evidence that the non-liquid asset ratios were the best predictors of long-term solvency. Beaver's 1966 study and the Dascher study point out that failed firms' non-liquid asset ratios, if observed several years before failure, tend toward a less favorable position when compared with non-failed firms. An alternate way to detect a degerating position is by observing a firm's ratio ranking. Dascher's work mentions that a failed company's average ratio rank worsens as the year of failure approaches.

A. 1966-1970

All of these symptoms, which have been shown to be highly predictive, were evident in Lockheed's situation as 1971 drew near. Accordingly, Lockheed was a likely candidate for bankruptcy in 1971.

1. Non-liquid Asset Ratios

While an analysis of most ratios supports a prediction of bankruptcy, the three non-liquid asset ratios clearly demonstrate this likelihood. In all three non-liquid asset ratios, Lockheed is below the industry mean in 1970. This supports Beaver's hypothesis of the non-liquid asset ratios being better indicators of long-term insolvency than liquid asset ratios. With regard to the working capital flow/total debt ratio (ratio #1), Lockheed had one bad year, 1968, and improved in all of the other years. In fact, the company is below the industry mean in 1966 and 1968 only. However, when

comparing this ratio to the other two funds flow ratios (ratios #2 and #3), certain phenomena become obvious.

In comparing the working capital flow/total debt ratio to funds flow from operations/total debt (ratio #3), it can be seen that most of Lockheed's working capital flow comes from sources other than operations. In Lockheed's case that source is primarily borrowing. Also, in comparing working capital flow/total debt to the net monetary assets flow/total debt ratio (ratio #2), it can be seen that a large portion of the increase in working capital is being invested in inventory. Lockheed's L-1011 inventory account in 1970 accounted for over 65 per cent of its total net inventory compared with less than 60 per cent in 1969. [Ref. 22, p. 28]

This L-1011 inventory's realization is so questionable that it was one of the principal causes for the company receiving a qualified opinion on its financial reports in 1969 and a disclaimer of opinion in 1970. (Subsequent to the loan guarantee approval, Lockheed received a supplemental report on 1970 from its auditors, Arthur Young & Company, in which they expressed a qualified opinion. [Ref. 22, p. 26])

2. Liquid Asset Ratios

The liquid asset ratios further support the findings of the non-liquid asset ratios.

a. Liquid Asset/Total Asset Ratios

The liquid assets/total assets ratios (ratios #6, #7, #8, and #9) show Lockheed's current assets/total assets ratio and working capital/total assets ratio improving, while its quick assets/total assets ratio is declining. This comparison again shows the growth of the

inventory account. The cash/total assets ratio appears to show no real trend. This is explained in that the cash is being supplied by long-term debt to supplement weak earnings. With total assets so greatly outweighing cash and with borrowing readily available to keep the cash account steady, it would take a large increase in total assets to decrease the ratio. For example, in 1968, Lockheed had total assets of approximately $937 million and cash of roughly $28 million. The ratio was, thus, .03. In order to increase the value of the ratio, say to .04, and increase of cash of only $10 million is needed if total assets are kept constant. Conversely, in order to increase the ratio to .04 with cash kept constant, a decrease in total assets of $237 million is needed. A large rise in borrowing with an accompanying increase in total assets needs only a small increase in cash to maintain a given ratio. (This assumes a year of no profit and no stock transactions.) Thus, the cash/total assets ratio isn't very meaningful when a company has a low cash/total assets ratio and ready availability to borrowings.

b. Liquid Asset/Current Debt Ratios

The liquid asset/current debt ratios (ratios #10, #11 and #12) show many of the same facts that the liquid asset/total assets ratios do. That is Lockheed is depending on the realization of its inventory account. More specifically, Lockheed is hoping to meet current obligations with current assets that are becoming more and more comprised of inventory. Lockheed's current assets are improving relative to current debt, but the current assets are internally shifting from highly realizable cash and accounts receivable to the not-so-realizable inventory. This can be seen by the degradation of the

quick ratio over time. The cash/current debt ratio is somewhat meaningless because of the same reasons set forth in the last paragraph. In fact, in this case, the numerator could be increased by long-term borrowing and the borrowing transaction would not even affect the denominator. This ratio, like the cash/total assets ratio, is meaningless.

c. Turnover Ratios

Quick assets/sales (ratio #14), while not improving, constantly outperforms the industry mean. Lockheed, having over 90 per cent of its sales to DOD, has many government accounts receivable. These are usually paid promptly. Hence, the favorable ratio results. When Lockheed's slow turning inventory is included, however, the current asset/sales and working capital/sales ratios (ratios #13 and #14) worsen dramatically with time. This points out Lockheed's dependence on ultimate realization of its inventories. The cash/sales ratio also becomes worse with time, except in 1971; but, like the other ratios with cash in the numerators, the value of this one is questionable also.

3. Rankings

Another way to look at solvency is to compare the yearly ratio rankings. Lockheed's average ranking for all ratios fell from 4.68 in 1966 to 5.93 in 1970. Moreover, its average ranking by Beaver's three non-liquid asset ratios declines spectacularly from 3.0 in 1966 to 10.66 in 1970. It should be noted that only ten firms were included in 1966 and 11 firms were included in 1970. Still, the decline is striking. The ranking by the two added ratios (ratios #1 and #2) gives interesting results. The working capital flow/total debt ratio (ratio #1) increases from position 6 to position 1, rather than decreasing.

However, when the effect of a rising inventory is eliminated in the net monetary assets flow/total debt ratio (ratio #2), the rank deteriorates from position 7 to position 9. This comparison of ratios #1 and #2 again shows Lockheed's dependence on inventory realization and L-1011 sales.

4. Conclusion of Thesis for Years 1966-1970

Lockheed was very probably headed toward bankruptcy in 1971. Not only was it out of cash (page 18), but many of its ratios had been deteriorating for five years. The non-liquid asset ratios especially show this degeneration. The only thing that prevents many of the liquid ratios from hovering near the bottom is the inventory account, which is carried on Lockheed's books at cost. (As is customary in the industry, inventory is carried at the lower of cost or net realizable value. Lockheed has stated that the cost is not in excess of estimated realizable value.) With the decline in L-1011 sales, however, the realization of those inventories is highly questionable.

Lockheed claimed it would fail without the loan guarantee. The CPA firm of Arthur Young & Company refused to issue an opinion on Lockheed's 1970 financial statements. With the guarantee, Arthur Young & Company did grant a qualified opinion. Apparently, they felt that the loan was necessary for Lockheed's survival.

This analysis of Lockheed shows a deterioration in many of the financial ratios (especially the non-liquid asset ratios) as 1971 approaches. In addition, the position of Lockheed's ratios in an industry ranking (again, especially the non-liquid ratios) deteriorates as 1971 draws near. In the three papers upon which this thesis is based, such occurrences have been found to be highly predictive of

failure. The findings of this thesis tend to corroborate the allegation by Lockheed's management that Lockheed was heading for bankruptcy in 1971.

B. 1971-1972

Although Lockheed had received the loan guarantee, it claimed to be heading for another financial crisis in late 1973. This was brought about mainly when financially troubled Eastern Air Lines delayed its scheduled acceptance of several L-1011s. Slack sales hurt the company also.

1. Non-liquid Asset Ratios

With the loan guarantee in 1971, many of Lockheed's financial ratios received a vital lift. Two of Beaver's non-liquid asset ratios--funds flow from operations/total debt (ratio #3) and net income/total assets (ratio #4)--showed vast improvement. However, the funds flow from operations/total debt ratio was still below the industry mean and total debt/total assets (ratio #5) understandably continued to worsen. Lockheed slightly exceeded the industry mean with the remaining funds flow ratios (ratios #1 and #2). This is explained by the fact that Lockheed's increased borrowings supported its working capital. (Lockheed borrowed $125 million in 1971 and $55 million in 1972.)

2. Liquid Asset Ratios

The trends established in the previous five years generally continued with regard to the liquid asset ratios. The ratios with inventory in the numerator (ratios #6, #8, #10, #13, and #15) showed a continued improvement, and most of the ratios without inventory in the numerator displayed a continual downward trend. The one notable exception in the latter category was the quick assets/sales

ratio, which continued to exceed the industry average. It too, however, showed a decrease. This decrease was due mostly to the decreased dependency on DOD. In 1971, 92 per cent of Lockheed's sales were to the Defense Department, while only 74 per cent of 1972's sales were to DOD. [Ref. 12, p. 2]

3. Rankings

After an initial lift from 5.93 in 1970 to 4.56 in 1971, Lockheed's average ranking for all ratios again deteriorated in 1972 to a rank of 5.37. (It should be noted that 11 firms were in the sample in 1970 and only ten in 1971 and 1972.) Likewise, Lockheed's average rank for the non-liquid asset ratios rises from 10.67 in 1970 to 7.33 in 1971, but the rank drops again to 9.0 in 1972.

4. Conclusions of the Thesis for Years 1971-1972

Again, Lockheed's problem lies in its increased inventory account and slow sales of the Tristar. In 1972 over 50 per cent of its total assets and over 70 per cent of its current assets were L-1011 inventories. The company had only 176 orders and options at the end of 1972 and, of these, only 17 were actually delivered. This is still far from an alleged breakeven point of 300. That breakeven point, itself, is considered highly optimistic.

Lockheed's financial ratios show its increased dependence on realization of its inventories. In order to improve the ratios, therefore, this inventory must be realized and sales must be increased.[2] With sales of the basic L-1011 drying up, the company has explored

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[2] Textron Corporation in May 1974 was willing to invest substantial equity capital in Lockheed Aircraft Corporation. This investment, however, was contingent upon Lockheed improving its financial position by obtaining 45 more firm orders of the L-1011 "Tristar" by November 1974.

the possibility of developing an extended-range version (L-1011-2) to boost sales. It would have a range of 6300 miles instead of the basic model's 3300 miles. [Ref. 23, p. 10] However, it will encounter competition from both the extended-range DC-10-30 and the jumbo Boeing 747. To complicate matters further, Lockheed's basic L-1011 can't extend its range significantly without major engineering changes. In contrast, the DC-10 can be extended with only minor modifications and, hence, much lower costs. Lockheed's current cash position will not support a very heavy outlay of funds. Hence, to compete effectively with the lower-cost DC-10-30, the company must increase sales substantially. [Ref. 24, p. 23]

Another source of sales could be in what the firm calls the L-1011-1. This version would require only small modifications but would have only a 4500 mile range. [Ref. 25, p. 4]

Lockheed's future is highly uncertain, and its financial ratios are heading again in the unfavorable direction. Nevertheless, the company is not facing financial disaster as it was in 1970. Unlike the last time, it has not claimed it was approaching bankruptcy and Arthur Young & Company does express an opinion, albeit a qualified opinion. While the values of the ratios and rankings are not the most enviable, it would be premature to suggest Lockheed is again facing bankruptcy. Its ratios merit constant scrutiny in the future, however, as Lockheed is indeed in a vulnerable position.

APPENDIX A

Company Measures

Boeing

(in $Thousands)

	1966	1967	1968	1969	1970	1971	1972
Work. Cap. Flow	116,301	156,253	176,808	115,555	120,462	112,039	106,325
Net Income	76,133	83,938	82,972	10,230	22,090	22,430	30,405
Total Debt	880,862	1,278,848	1,375,758	1,806,428	1,812,386	1,621,454	1,262,577
Current Assets	801,982	1,062,664	1,256,128	1,690,528	1,769,248	1,727,281	1,463,376
Quick Assets	278,553	268,454	214,101	273,349	266,908	346,302	323,208
Net Working Cap.	434,250	358,251	467,001	610,467	656,618	694,791	738,537
Cash	72,240	64,042	58,352	81,205	63,265	88,261	50,952
Funds Flow	167,500	-(76,000)	108,700	143,500	46,200	38,200	43,700
Mont. Assets Flow	((47,250)	(365,423)	(255,214)	(176,331)	498,431	398,525	(56,534)
Total Assets	1,144,519	2,030,440	2,186,119	2,602,444	2,621,819	2,464,424	2,127,396
Current Debt	367,732	704,413	789,127	1,080,061	1,112,630	1,032,496	724,839
Sales	2,356,569	2,879,686	3,273,980	2,834,585	3,677,073	3,039,816	2,369,580

Curtiss-Wright

Work. Cap. Flow	13,338	16,765	17,776	20,782	9,426	11,210	14,879
Net Income	8,684	11,530	11,397	12,243	(1,573)	318	4,787
Total Debt	56,830	51,356	74,440	119,169	126,253	99,588	90,470
Current Assets	159,658	147,741	147,101	168,917	159,438	145,741	161,624
Quick Assets	124,077	105,158	92,970	102,136	100,124	104,278	128,579
Net Working Cap.	106,840	102,049	96,104	91,073	70,436	77,071	91,700
Cash	2,380	1,879	4,171	5,860	7,779	6,271	5,078
Funds Flow	(2,131)	(4,791)	(9,063)	(5,032)	(20,638)	6,635	14,829
Mont. Assets Flow	(9,333)	(11,797)	(10,201)	(19,611)	(15,125)	20,657	21,226
Total Assets	216,504	214,744	240,656	290,126	283,987	257,980	256,965
Current Debt	52,818	45,692	50,997	77,844	89,002	68,670	69,724
Sales	144,114	173,709	170,581	261,874	264,524	248,671	235,561

General Dynamics

	1966	1967	1968	1969	1970	1971	1972
Work. Cap. Flow	86,615	89,285	75,686	52,409	41,842	70,702	76,479
Net Income	53,954	51,289	29,756	2,531	(6,506)	20,621	26,042
Total Debt	447,434	584,322	530,176	737,625	779,717	832,675	652,204
Current Assets	458,303	596,736	586,512	711,075	734,764	795,525	636,724
Quick Assets	133,665	154,668	135,417	151,578	125,649	182,485	168,975
Net Working Cap.	157,541	165,461	142,914	163,608	151,095	158,458	181,586
Cash	16,280	33,340	34,600	31,954	6,433	29,292	17,881
Funds Flow	(26,090)	7,019	(22,547)	20,694	(12,513)	7,363	23,128
Mont. Assets Flow	(8,134)	(44,089)	(6,031)	(32,168)	52,997	(38,915)	4,883
Total Assets	733,536	920,408	865,932	1,066,082	1,096,398	1,171,397	1,015,405
Current Debt	300,761	431,275	443,598	547,467	583,669	637,067	455,138
Sales	1,539,390	1,868,801	2,223,643	2,508,755	2,662,237	2,253,336	1,796,990

Grumann

Work. Cap. Flow	36,725	34,083	36,422	43,541	43,911	3,880	(50,387)
Net Income	27,622	21,450	19,037	22,087	20,271	21,869	(70,026)
Total Debt	172,370	184,648	211,311	216,091	218,929	225,424	309,901
Current Assets	209,102	219,390	236,214	238,044	252,608	237,721	261,246
Quick Assets	100,270	89,873	120,383	146,959	133,334	93,163	108,547
Net Working Cap.	70,533	118,502	108,674	104,161	124,619	105,191	96,144
Cash	5,634	8,614	6,792	6,964	12,278	9,819	24,479
Funds Flow	6,440	47,969	(9,828)	(4,513)	20,458	(20,865)	(9,047)
Mont. Assets Flow	(32,796)	27,284	3,858	20,233	(7,731)	(14,149)	(4,389)
Total Assets	286,251	315,335	354,345	374,004	386,827	364,644	377,166
Current Debt	138,569	100,887	127,540	133,883	127,989	132,530	165,102
Sales	1,059,379	968,596	1,152,511	1,180,328	993,260	799,821	683,456

LTV Aerospace

	1966	1967	1968	1969	1970	1971	1972
Work. Cap. Flow	7,243	11,486	24,394	40,779	23,286		
Net Income	5,809	9,578	14,976	28,740	6,009		
Total Debt	78,339	163,781	245,222	263,820	309,755		
Current Assets	90,981	179,661	277,926	389,369	344,589		
Quick Assets	52,688	81,680	164,649	264,977	234,494		
Net Working Cap	39,241	43,474	82,268	76,932	96,987		
Cash	18,170	14,289	12,971	31,510	31,447		
Funds Flow	39,098	4,233	39,794	(6,336)	20,055		
Mont. Assets Flow	19,359	(55,455)	24,528	(26,281)	3,242		
Total Assets	104,085	198,628	322,933	475,748	431,380		
Current Debt	51,740	136,187	194,658	312,437	247,602		
Sales	231,552	343,696	527,652	714,001	820,153		

Mc Donnell-Douglas

Work. Cap. Flow	46,364	34,917	130,845	161,138	136,582	128,504	159,504
Net Income	18,255	893	94,724	117,645	92,565	80,914	111,674
Total Debt	862,504	1,001,975	875,793	962,603	1,142,175	1,399,888	1,566,301
Current Assets	807,961	892,047	751,447	820,857	912,276	1,182,492	1,462,408
Quick Assets	204,062	199,504	173,012	189,017	172,921	170,883	130,710
Net Working Cap.	150,918	69,026	112,295	160,512	172,159	223,544	343,090
Cash	13,609	33,726	6,110	16,800	51,446	58,171	11,639
Funds Flow	(70,237)	(81,892)	43,269	48,217	11,647	61,385	109,546
Mont. Assets Flow	(444,053)	(170,536)	167,106	23,068	(75,501)	(259,221)	(40,544)
Total Assets	1,227,075	1,365,861	1,335,099	1,536,272	1,769,344	2,119,533	2,400,278
Current Debt	657,043	823,020	639,152	660,345	740,117	948,947	1,119,318
Sales	2,239,368	2,933,753	3,609,295	3,023,829	2,088,179	2,069,060	2,725,683

Northrup

	1966	1967	1968	1969	1970	1971	1972
Work. Cap. Flow	17,222	19,376	24,601	28,239	30,848	22,216	22,806
Net Income	10,474	12,567	15,740	18,501	19,930	10,995	11,136
Total Debt	113,707	190,429	276,236	347,848	373,784	221,550	195,364
Current Assets	141,915	193,175	320,117	392,627	419,527	261,365	222,455
Quick Assets	65,948	63,416	77,841	135,506	226,525	163,874	92,980
Net Working Cap.	57,231	83,655	165,382	170,573	171,789	114,857	100,120
Cash	4,224	18,726	25,376	28,058	37,225	15,095	10,008
Funds Flow	6,062	26,424	81,727	5,191	1,216	(36,947)	(5,087)
Mont. Assets Flow	-(13,698)	(374)	(49,488)	(11,810)	64,396	57,468	-(34,015)
Total Assets	200,026	300,706	400,082	487,908	526,621	376,148	347,173
Current Debt	84,683	109,510	154,734	222,054	247,737	146,508	122,335
Sales	357,278	469,448	485,503	561,200	626,920	573,943	573,749

Rockwell

Work. Cap. Flow	147,433	135,804	133,524	128,994	135,696
Net Income	81,156	64,916	64,706	68,629	77,919
Total Debt	779,820	837,952	784,633	620,738	720,515
Current Assets	1,055,695	1,029,699	730,557	780,770	870,707
Quick Assets	542,027	521,983	471,406	379,586	412,978
Net Working Cap.	615,044	528,209	465,618	436,399	450,491
Cash	68,397	48,782	71,690	90,377	110,308
Funds Flow	135,932	(86,835)	(62,591)	(29,017)	14,362
Mont. Assets Flow	55,698	(80,883)	(12,026)	38,624	(34,770)
Total Assets	1,528,442	1,590,726	1,515,399	1,381,228	1,515,128
Current Debt	440,651	501,490	464,939	344,371	420,216
Sales	2,803,146	2,667,238	2,310,752	2,210,704	2,362,938

Teledyne

	1966	1967	1968	1969	1970	1971	1972
Work. Cap. Flow	74,783	89,460	211,216	242,528	266,858	274,993	291,058
Net Income	16,844	21,745	45,592	60,103	64,120	56,179	57,444
Total Debt	124,778	184,611	294,138	425,800	376,868	639,556	621,952
Current Assets	160,542	218,170	359,470	496,313	430,644	416,504	427,126
Quick Assets	78,465	116,212	185,110	242,872	190,862	218,568	229,750
Net Working Cap.	76,588	149,942	237,773	297,706	283,678	281,601	263,017
Cash	16,223	11,862	31,219	28,250	31,432	53,536	48,687
Funds Flow	45,785	73,354	87,831	59,933	(14,028)	(2,077)	(18,584)
Mont.Assets Flow	(16,210)	53,474	15,429	(19,148)	631	39,769	(18,024)
Total Assets	246,619	337,703	661,225	944,237	971,067	1,075,706	1,441,986
Current Debt	83,954	68,228	121,697	198,607	146,966	134,903	164,109
Sales	394,583	451,060	874,905	1,294,775	1,216,448	1,101,872	1,215,991

United Aircraft

Work. Cap. Flow	87,965	108,896	126,637	126,474	121,006	32,114	124,716
Net Income	46,515	57,309	61,393	50,909	45,279	(45,942)	50,600
Total Debt	629,434	779,851	854,431	954,204	988,209	891,458	688,445
Current Assets	724,305	824,580	901,502	1,049,832	1,105,712	979,620	842,724
Quick Assets	334,987	424,638	407,296	488,791	608,477	552,321	438,549
Net Working Cap.	236,478	301,455	303,428	347,348	362,084	326,635	386,017
Cash	58,395	58,755	62,569	69,472	75,609	65,844	60,198
Funds Flow	(30,212)	64,977	1,973	42,920	14,736	(54,847)	59,382
Mont. Assets Flow	(148,880)	64,353	(50,693)	(20,327)	(28,791)	(195,401)	20,550
Total Assets	1,046,165	1,240,361	1,357,759	1,488,355	1,546,374	1,397,371	1,223,573
Current Debt	487,826	523,124	598,074	702,483	743,628	652,985	456,707
Sales	1,665,534	2,214,690	2,411,505	2,354,355	2,352,603	2,039,772	2,034,657

Lockheed

	1966	1967	1968	1969	1970	1971	1972
Work. Cap. Flow	79,561	85,352	58,521	11,509	(29,927)	70,011	63,982
Net Income	58,883	54,359	44,476	(32,642)	(86,282)	15,429	16,211
Total Debt	409,418	531,253	566,095	950,403	1,087,870	1,220,987	1,365,827
Current Assets	546,753	660,235	663,237	926,897	971,911	1,165,063	1,361,159
Quick Assets	231,651	355,922	343,206	296,837	258,584	283,271	263,867
Net Working Cap.	169,729	293,023	235,267	312,744	468,416	651,516	755,957
Cash	25,183	30,801	27,720	52,062	40,207	82,485	88,964
Funds Flow	(13,653)	123,294	(57,756)	77,477	155,672	183,160	104,381
Mont. Assets Flow	(68,501)	134,083	(51,673)	(140,052)	(41,895)	14,695	108,899
Total Assets	727,015	881,030	936,783	1,271,444	1,322,629	1,471,175	1,632,226
Current Debt	377,024	367,212	427,970	614,153	503,495	513,487	605,202
Sales	2,084,759	2,335,456	2,217,366	2,074,639	2,535,603	2,852,365	2,472,732

APPENDIX B

Company Ratios, Means and Standard Deviations

RATIO #1 $\frac{\text{Working Capital Funds Flow}}{\text{Total Debt}}$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.1902	-.0594	.0790	.0794	.0255	.0236	.0346
Curtiss-Wright	-.0375	-.0933	-.1217	-.0422	-.1635	.0666	.1639
Gen. Dynamics	-.0583	.0136	-.0425	.0281	-.0160	.0088	.0355
Grumann	.0374	.2598	-.0465	-.0209	.0934	-.0926	-.0292
LTV Aerospace	.4991	.0258	.1623	.0240	.0647		
McDonnell-Douglas	-.0814	-.0817	.0494	.0501	.0102	.0438	.0699
Northrup	.0533	.1388	.2958	.0149	.0033	-.1668	-.0260
Rockwell Int.			.0889	-.0546	-.0413	.0210	.0095
Teledyne	.3669	.3973	.2986	.1407	-.0372	-.0032	-.0299
United Aircraft	.0480	.0833	.0023	.0450	.0149	-.0615	.0863
Mean (μ)	.1024	.0760	.0766	.0265	-.0046	.0178	.0350
Std. Dev. (σ)	.2072	.1656	.1413	.0639	.0697	.0748	.0644
Lockheed	.0330	.2320	-.1020	.0820	.1430	.1500	.0750

RATIO# 2 $\frac{\text{Net Monetary Assets Funds Flow}}{\text{Total Debt}}$

	1966	1967	1968	1969	1970	1971	1972
Boeing	-.0536	-.2857	-.1637	-.0976	.2750	.2458	-.0448
Curtiss-Wright	-.1642	-.2297	-.1370	-.1646	-.1198	.2074	.2346
Gen. Dynamics	.1935	.1528	.1428	.0711	.0537	.0849	.1173
Grumann	-.1903	.1478	.0183	.0936	-.0353	-.0628	-.0142
LTV Aerospace	.2471	-.3386	.1000	-.0996	.0105		
McDonnell-Douglas	-.5148	-.1742	.1908	.0240	-.0661	-.1851	-.0259
Northrup	-.1205	.0020	-.1792	-.0340	.1715	.2594	-.1741
Rockwell Int.			.0364	-.0508	-.0079	.0280	-.0229
Teledyne	-.1299	.2906	.0525	-.0450	.0017	.0622	-.0290
United Aircraft	-.2365	.0825	-.0593	-.0213	-.0291	.2192	.0298
Mean (μ)	-.1077	-.0392	.0002	-.0324	.0254	.0467	.0079
Std. Dev. (σ)	.2271	.2242	.1301	.0793	.1166	.1765	.1138
Lockheed	-.1673	.2524	-.0913	-.1474	-.0385	.0120	.0797

RATIO #3 $\frac{\text{Funds Flow}}{\text{Total Debt}}$

Boeing	.1320	.1222	.1285	.0640	.0665	.0691	.0842
Curtiss-Wright	.2347	.3264	.2388	.1744	.0747	.1127	.1645
Gen. Dynamics	-.0182	-.0755	-.0114	-.0436	.0680	-.0467	.0075
Grumann	.2131	.1846	.1724	.2015	.2006	.0172	-.1626
LTV Aerospace	.0925	.0701	.0995	.1546	.0752		
McDonnell-Douglas	.0538	.0348	.1494	.1674	.1196	.0918	.1018
Northrup	.1515	.1017	.0891	.0812	.0825	.1003	.1167
Rockwell Int.			.0965	.0854	.0881	.0934	.0896
Teledyne	.5993	.4846	.7181	.5096	.7081	.4300	.4680
United Aircraft	.1398	.1396	.1482	.1325	.1224	.0360	.1813
Mean (μ)	.1776	.1543	.1829	.1587	.1605	.1922	.1168
Std. Dev. (σ)	.1759	.1650	.1989	.1609	.1966	.3031	.1665
Lockheed	.1943	.1606	.1034	.0121	-.0275	.0573	.0468

RATIO #4

$$\frac{\text{Net Income}}{\text{Total Assets}}$$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.0665	.0413	.0380	.0039	.0084	.0091	.0143
Curtiss-Wright	.0401	.0537	.0474	.0422	-.0055	.0012	.0186
Gen. Dynamics	.0736	.0557	.0344	.0024	-.0059	.0176	.0256
Grumann	.0965	.0680	.0537	.0591	.0524	-.0493	-.1857
LTV Aerospace	.0558	.0482	.0464	.0604	.0139		
McDonnell-Douglas	.0149	.0007	.0709	.0766	.0523	.0382	.0465
Northrup	.0524	.0418	.0393	.0379	.0378	.0292	.0320
Rockwell Int.			.0531	.0408	.0427	.0497	.0514
Teledyne	.0683	.0644	.0690	.0637	.0660	.0522	.0398
United Aircraft	.0444	.0462	.0452	.0342	.0293	-.0314	.0414
Mean (μ)	.0569	.0467	.0497	.0421	.0291	.0129	.0093
Std. Dev. (σ)	.0242	.0196	.0123	.0245	.0253	.0350	.0742
Lockheed	.0810	.0620	.0470	-.0260	-.0650	.0100	.0100

RATIO #5

$$\frac{\text{Total Debt}}{\text{Total Assets}}$$

Boeing	.7696	.6298	.6293	.6941	.6913	.6579	.5935
Curtiss-Wright	.2625	.2391	.3093	.4107	.4446	.3860	.3521
Gen. Dynamics	.6000	.6349	.6123	.6919	.7112	.7108	.6423
Grumann	.6022	.5856	.5963	.5778	.5660	.7005	.8217
LTV Aerospace	.7526	.8247	.7594	.5545	.7180		
McDonnell-Douglas	.7029	.7326	.6560	.6266	.6455	.6605	.6525
Northrup	.5685	.6333	.6904	.7129	.7098	.5890	.5627
Rockwell Int.			.5102	.5268	.5778	.4494	.4755
Teledyne	.5060	.5467	.4448	.4509	.3881	.5945	.4313
United Aircraft	.6017	.6287	.6293	.6411	.6391	.6380	.5627
Mean (μ)	.5962	.6062	.5837	.5837	.6031	.5985	.5660
Std. Dev. (σ)	.1526	.1601	.1300	.1302	.1189	.1115	.1376
Lockheed	.5630	.6030	.6040	.7470	.8230	.8300	.8370

RATIO #6 $\frac{\text{Current Assets}}{\text{Total Assets}}$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.7007	.5234	.5746	.6496	.6748	.7009	.6879
Curtiss-Wright	.7374	.6880	.6113	.5822	.5614	.5649	.6290
Gen. Dynamics	.6248	.6483	.6773	.6670	.6702	.6791	.6271
Grumann	.7305	.6957	.6666	.6365	.6530	.6519	.6927
LTV Aerospace	.8741	.9045	.8606	.8184	.7988		
McDonnell-Douglas	.6584	.6531	.5628	.5343	.5156	.5579	.6093
Northrup	.7095	.6424	.8001	.8047	.7966	.6948	.6407
Rockwell Int.			.6907	.6473	.6141	.5653	.5747
Teledyne	.6510	.6460	.5436	.5256	.4435	.3872	.2962
United Aircraft	.6923	.6648	.6640	.7054	.7150	.7010	.6887
Mean (μ)	.7087	.6740	.6642	.6571	.6443	.6114	.6051
Std. Dev. (σ)	.0723	.0997	.0999	.0993	.1147	.1041	.1226
Lockheed	.7521	.7494	.7080	.7290	.7348	.7919	.8239

RATIO #7 $\frac{\text{Quick Assets}}{\text{Total Assets}}$

Boeing	.2434	.1322	.0979	.1050	.1018	.1405	.1519
Curtiss-Wright	.5731	.4897	.3863	.3520	.3526	.4042	.5003
Gen. Dynamics	.1822	.1714	.1563	.1422	.1146	.1558	.1664
Grumann	.3503	.2850	.3397	.3929	.3447	.2555	.2878
LTV Aerospace	.5062	.4112	.5099	.5070	.5436		
McDonnell-Douglas	.1663	.1461	.1296	.1230	.0977	.0806	.0545
Northrup	.3297	.2109	.1946	.2777	.4301	.4357	.2678
Rockwell Int.			.3546	.3281	.3111	.2748	.2726
Teledyne	.3182	.3441	.2800	.2572	.1965	.2032	.1593
United Aircraft	.3202	.3424	.3000	.3284	.3935	.3953	.3584
Mean (μ)	.3322	.2814	.2749	.2814	.2886	.2606	.2466
Std. Dev. (σ)	.1355	.1253	.1299	.1286	.1542	.1278	.1321
Lockheed	.3186	.4040	.3664	.2335	.1955	.1925	.1617

RATIO #8

$$\frac{\text{Working Capital}}{\text{Total Assets}}$$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.3794	.1764	.2136	.2346	.2504	.2819	.3472
Curtiss-Wright	.4935	.4752	.3993	.3139	.2480	.2987	.3576
Gen. Dynamics	.2148	.1798	.1650	.1535	.1378	.1353	.1788
Grumann	.2464	.3758	.3067	.2785	.3222	.2885	.2549
LTV Aerospace	.3770	.2188	.2578	.1617	.2248		
McDonnell-Douglas	.1230	.0505	.0841	.1045	.0973	.1055	.1429
Northrup	.2861	.2782	.4134	.3496	.3262	.3054	.2884
Rockwell Int.			.4024	.3321	.3073	.3160	.2973
Teledyne	.3106	.4440	.3596	.3153	.2921	.2618	.1824
United Aircraft	.2260	.2430	.2235	.2334	.2341	.2337	.3155
Mean (μ)	.2952	.2713	.2825	.2477	.2440	.2474	.2628
Std. Dev. (σ)	.1099	.1379	.1124	.0847	.0764	.0764	.0780
Lockheed	.2335	.3326	.2511	.2460	.3542	.4429	.4631

RATIO #9

$$\frac{\text{Cash}}{\text{Total Assets}}$$

Boeing	.0031	.0315	.0267	.0312	.0241	.0358	.0240
Curtiss-Wright	.0110	.0087	.0173	.0202	.0274	.0243	.0198
Gen. Dynamics	.0222	.0362	.0400	.0300	.0059	.0250	.0176
Grumann	.0197	.0273	.0192	.0186	.0317	.0269	.0649
LTV Aerospace	.1746	.0719	.0402	.0662	.0729		
McDonnell-Douglas	.0111	.0247	.0046	.0109	.0291	.0274	.0048
Northrup	.0211	.0623	.0634	.0575	.0707	.0401	.0288
Rockwell Int.			.0447	.0307	.0473	.0654	.0728
Teledyne	.0658	.0351	.0472	.0299	.0324	.0498	.0338
United Aircraft	.0558	.0474	.0461	.0467	.0489	.0471	.0492
Mean (μ)	.0494	.0383	.0349	.0342	.0390	.0380	.0351
Std. Dev. (σ)	.0519	.0194	.0176	.0175	.0210	.0140	.0227
Lockheed	.0346	.0350	.0296	.0409	.0304	.0561	.0545

RATIO #10

$$\frac{\text{Current Assets}}{\text{Current Debt}}$$

	1966	1967	1968	1969	1970	1971	1972
Boeing	2.18	1.51	1.39	1.57	1.59	1.67	2.02
Curtiss-Wright	3.08	3.23	2.77	2.17	1.79	2.12	2.32
Gen. Dynamics	1.52	1.38	1.32	1.30	1.26	1.25	1.40
Grumann	1.51	2.17	1.85	1.78	1.97	1.79	1.58
LTV Aerospace	1.76	1.32	1.43	1.25	1.39		
McDonnell-Douglas	1.23	1.08	1.18	1.24	1.23	1.25	1.31
Northrup	1.68	1.76	2.07	1.77	1.69	1.78	1.82
Rockwell Int.			2.40	2.05	2.00	2.27	2.07
Teledyne	1.91	3.20	2.95	2.50	2.93	3.08	2.60
United Aircraft	1.48	1.67	1.57	1.49	1.49	1.50	1.85
Mean (μ)	1.82	1.57	1.89	1.71	1.73	1.86	1.89
Std. Dev. (σ)	.55	1.47	.63	.42	.50	.58	.42
Lockheed	1.45	1.80	1.55	1.51	1.93	2.27	2.25

RATIO #11

$$\frac{\text{Quick Assets}}{\text{Current Debt}}$$

Boeing	.7575	.3811	.2713	.2531	.2399	.3354	.4459
Curtiss-Wright	2.35	2.30	1.82	1.31	1.12	1.52	1.84
Gen. Dynamics	.44	.36	.31	.28	.22	.29	.37
Grumann	.72	.89	.94	1.10	1.04	.70	.66
LTV Aerospace	1.02	.60	.85	.85	.95		
McDonnell-Douglas	.31	.24	.27	.29	.23	.18	.12
Northrup	.78	.58	.50	.61	.91	1.12	.76
Rockwell Int.			1.23	1.04	1.01	1.10	.98
Teledyne	.93	1.70	1.52	1.22	1.30	1.62	1.40
United Aircraft	.69	.81	.68	.70	.82	.85	.96
Mean (μ)	.89	.87	.84	.77	.78	.86	.84
Std. Dev. (σ)	.59	.69	.54	.40	.40	.53	.53
Lockheed	.61	.97	.85	.67	.51	.55	.44

RATIO #12

$$\frac{\text{Cash}}{\text{Current Debt}}$$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.1964	.0909	.0739	.0752	.0569	.0855	.0703
Curtiss-Wright	.0451	.0411	.0818	.0753	.0874	.0913	.0728
Gen. Dynamics	.0541	.0773	.0780	.0583	.0110	.0460	.0393
Grumann	.0407	.0854	.0532	.0520	.0959	.0741	.1483
LTV Aerospace	.3512	.1049	.0666	.1008	.1270		
McDonnell-Douglas	.0207	.0410	.0096	.0254	.0695	.0613	.0104
Northrup	.0499	.1709	.1640	.1263	.1503	.1030	.0818
Rockwell Int.			.1552	.0973	.1542	.2624	.2625
Teledyne	.1932	.1739	.2565	.1422	.2139	.3968	.2966
United Aircraft	.1197	.1123	.1046	.0989	.1017	.1008	.1318
Mean (μ)	.1190	.0997	.1043	.0852	.1068	.1357	.1238
Std. Dev. (σ)	.1093	.0480	.0703	.0351	.0573	.1164	.0981
Lockheed	.0668	.0839	.0648	.0848	.0799	.1606	.1470

RATIO #13

$$\frac{\text{Current Assets}}{\text{Sales}}$$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.3403	.3690	.3837	.5964	.4811	.5682	.6176
Curtiss-Wright	.1078	.8505	.8624	.6450	.6027	.5860	.6861
Gen. Dynamics	.2977	.3193	.2638	.2834	.2760	.3530	.3543
Grumann	.1973	.2265	.2049	.2017	.2543	.2972	.3822
LTV Aerospace	.3929	.5227	.5267	.5453	.4202		
McDonnell-Douglas	.3608	.3040	.2082	.2715	.4369	.5715	.5365
Northrup	.3972	.4115	.6593	.6996	.6692	.4554	.3877
Rockwell Int.			.3766	.3860	.3860	.3531	.3685
Teledyne	.4069	.4837	.4109	.3833	.3540	.3780	.3513
United Aircraft	.4344	.3723	.3738	.4459	.4700	.4803	.4142
Mean (μ)	.4372	.4288	.4270	.4458	.4350	.4492	.4554
Std. Dev. (σ)	.2614	.1821	.2068	.1701	.1306	.1093	.1257
Lockheed	.2623	.2827	.2991	.4468	.3833	.4085	.5505

RATIO #14 $\frac{\text{Quick Assets}}{\text{Sales}}$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.1182	.0932	.0654	.0964	.0726	.1139	.1364
Curtiss-Wright	.8609	.6054	.5450	.3900	.3785	.4193	.5458
Gen. Dynamics	.0868	.0827	.0609	.0604	.0472	.0810	.0940
Grumann	.0946	.0928	.1044	.1245	.1342	.1165	.1588
LTV Aerospace	.2275	.2377	.3120	.3711	.2859		
McDonnell-Douglas	.0911	.0680	.0479	.0625	.0828	.0826	.0480
Northrup	.1846	.1351	.1596	.2415	.3613	.2855	.1621
Rockwell Int.			.1934	.1957	.1955	.1717	.1748
Teledyne	.1988	.2576	.2116	.1876	.1574	.1984	.1889
United Aircraft	.2011	.1917	.1689	.2076	.2586	.2708	.2155
Mean (μ)	.2293	.1960	.1869	.1899	.1974	.1933	.1916
Std. Dev. (σ)	.2430	.1686	.1500	.1169	.1193	.1135	.1421
Lockheed	.1111	.1524	.1548	.1431	.1020	.0993	.1067

RATIO #15 $\frac{\text{Working Capital}}{\text{Sales}}$

Boeing	.1843	.1244	.1426	.2154	.1785	.2286	.3116
Curtiss-Wright	.7414	.5874	.5634	.3478	.2662	.3099	.3901
Gen. Dynamics	.1023	.0885	.0643	.0652	.0568	.0703	.1011
Grumann	.0666	.1223	.0942	.0882	.1255	.1315	.1407
LTV Aerospace	.1695	.1265	.1578	.1077	.1183		
McDonnell-Douglas	.0674	.0235	.0311	.0531	.0824	.1080	.1259
Northrup	.1602	.1782	.3406	.3039	.2740	.2001	.1745
Rockwell Int.			.2194	.1980	.1931	.1974	.1906
Teledyne	.1941	.3324	.2718	.2299	.2332	.2556	.2163
United Aircraft	.1420	.1361	.1258	.1475	.1113	.1601	.1897
Mean (μ)	.2031	.1910	.2011	.1757	.1639	.1846	.2045
Std. Dev. (σ)	.2074	.1704	.1584	.1008	.0767	.0754	.0924
Lockheed	.0814	.1255	.1061	.1507	.1847	.2284	.3057

RATIO #16 $\frac{\text{Cash}}{\text{Sales}}$

	1966	1967	1968	1969	1970	1971	1972
Boeing	.0306	.0222	.0178	.0286	.0172	.0290	.0215
Curtiss-Wright	.0165	.0108	.0244	.0224	.0294	.0252	.0216
Gen. Dynamics	.0106	.0178	.0156	.0127	.0024	.0130	.0100
Grumann	.0005	.0089	.0059	.0059	.0124	.0123	.0358
LTV Aerospace	.0785	.0416	.0246	.0441	.0383		
McDonnell-Douglas	.0061	.0115	.0017	.0056	.0246	.0281	.0043
Northrup	.0118	.0397	.0523	.0500	.0594	.0263	.0174
Rockwell Int.			.0244	.0182	.0297	.0409	.0467
Teledyne	.0411	.0263	.0357	.0218	.0258	.0486	.0400
United Aircraft	.0351	.0265	.0259	.0295	.0321	.0323	.0296
Mean (μ)	.0256	.0228	.0228	.0239	.0271	.0284	.0252
Std. Dev. (σ)	.0241	.0120	.0144	.0148	.0154	.0117	.0140
Lockheed	.0121	.0132	.0125	.0251	.0159	.0289	.0360

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